The
# Electrical Review

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## A "Power" Special Number

OUR critics tell us that this country has much leeway to make up before we can regard ourselves as being as well equipped electrically as our chief foreign competitors.

When we pay heed to this criticism we may remark that competitors who entered later into the industrial field itself have not, in some of their industries, been handicapped by owning plant which, however good in its day, represents a big capital investment which must be written off when the time comes to modernise. Moreover, the cobbler's children are proverbially badly shod; and Britain, which has sent electrical plant all over the world, may not have done so much for itself industrially as it has for its overseas customers in other ways. But our critics have grossly exaggerated the charge. It is only necessary to look through the pages of the ELECTRICAL REVIEW week by week to realise how widespread and varied are the applications of electricity in British industry.

One thing we will admit. However great the industrial uses of electricity, they can be increased manyfold. By taking thought we *can* add to our electrical stature; and it is the manifest duty of everyone connected with our industry to do his utmost to ensure that increase.

The ELECTRICAL REVIEW fully recognises that it has to play a leading part in this most important movement. Hence this special "Power Number," which is not merely a collection of miscellaneous contributions, but has been thought out, as a whole, to help the manufacturer who is putting down new plant or replacing old, by giving him the views and advice of leading specialists on each question likely to concern him.

The topics are dealt with consecutively. Starting with the choice of sites for electrically equipped factories, we have the problem of public supply as against the self-contained plant, checking consumption on individual circuits to ensure economy, factory wiring and lighting, motors and their application, works handling equipment, intercommunication in factories, electric welding, riveting and heating, some chemical applications of electricity, and the works canteen. The series appropriately closes with a review of the progress of recent years and of what remains to be done.

Throughout our articles will be found descriptions, with many illustrations taken specially for this issue, of British works, showing how electrical energy is already being applied to such widely varying purposes as the manufacture of pottery and pencils, biscuits and boots, cocoa and furniture, soap and alloy steels, textiles and tar-macadam, envelopes and railway rolling-stock.

The more rapid the development of the use of electric power the cheaper the charge will be to the householder, so that indirectly a "Power" issue is a "Domestic" issue also.

To-day is particularly favourable for such a departure, because recent events are resulting in the erection of new works and the extension of existing works, largely to fill gaps in the home market caused by the check put upon imports, but, incidentally, also that we may be prepared for the revival of world trade, which must come sooner or later. Moreover, every day sees the range of electrical applications widened and electrical energy available cheaply where hitherto it has been unobtainable or prohibitively costly.

The members of the I.M.E.A., who are now meeting at Cardiff, represent a large section of the supply undertakings, whose direct interest it is to improve the

efficiency of the present applications and to find new purposes which electricity can advantageously serve. We hope that all such undertakings, municipal and company alike, will find the material brought together in this "Power Number" of great value in making their propaganda efforts.

**The I.M.E.A. President's Address**

MR. C. J. MORLEY NEW, in his presidential address to the I.M.E.A., took his text from Lewis Carroll: "The time has come . . . . to talk of many things." It was a wide survey of the electricity supply position that he gave us, but the keynote seemed to us to be his words "regional outlook is required" in order to sell the greatest number of units to the greatest number of people at the lowest possible price. If this regional outlook prevailed everywhere, as it does in some municipalities, it would solve the question of availability of supply in outlying areas, but it entails increased responsibilities to the engineers, and initiative is so often inadequately rewarded by local authorities. The President emphasised that full support of E.D.A. must be supplemented by local effort, and this should include not only publicity to create electrical mindedness, but also skilful interpretation to the hard-headed manufacturer of what electricity can do for him.

**The Larger Co-operation**

As an example of the need for larger co-operation Mr. Morley New referred to the difficulty found by some undertakings in taking on loads of a magnitude that would alter the peak incidence on the local system but which would require off-peak rates to secure them—an aspect of the value of inter-connection that perhaps has not received as much attention as it deserves. The question of frequency standardisation was raised at the first I.M.E.A. Convention, thirty-six years ago. How much money would have been saved had this far-seeing proposal been carried out then! The President gives a word of comfort to those who fear that present tendencies in co-ordination will reduce the call for men in the supply industry. Over seven recent years covered by official statistics the number of units sold per man increased by over one-third, but the number employed increased by more than two-thirds. We hope this presages that the many first-class men now disengaged will early find a field for their activities.

**Increased Consumption Maintained**

THE reports which we have received from many parts of the country of increasing industrial power loads are borne out by the monthly returns of the Electricity Commissioners for May, which show an increase of 11.6 per cent. over the same month last year. The increase for the first five months of this year is now 8.3 per cent., so that the present rate of progress, if maintained, should enable us to pass the 10 per cent. mark at the end of the year, and even to make up for some of last year's deficiency. The public's faith in electricity supply investment was amply demonstrated by the immediate success of the Central Electricity Board's issue this week.

**An Electrical Foreman**

Two of the contributors to the present issue refer to a particular merit of electricity in industry in enabling accurate information to be obtained as to the power cost of different processes. Now labour is usually more expensive than power, and we recall a conversation with the manager of a works which had been changed over to an electric drive. He was enthusiastic about the economies with power, but even more so about the savings effected by a recording ammeter in his office. The charts immediately after the installation of the instrument showed a very gradual rise in the consumption curve in the mornings and after meal hours, and a similar gradual easing off before 5 p.m. He took the requisite steps, with the result that later charts indicated a prompt restarting of work and, we were informed, an increase in output sufficient to pay the cost of the instrument within a few weeks.

**Scientific Management Congress**

THE evolution of management in industry as a profession is being recognised as one of the most important aspects of industrial life. An excellent occasion for the pooling of ideas and experience on the trend of modern practice will occur next month at the Fifth International Scientific Management Congress in Amsterdam. The proceedings, which will last from July 18th to 23rd, will include discussions on papers dealing with standard costing, market research, the education of foremen, production incentives, promotion methods, and retail distribution problems. Industrialists from many lands will be present, the arrangements having been made by an international committee acting in collaboration with central bodies in each country.

**Factory Heating**

ONE impression of many recent visits to all kinds of industrial works is that very little electrical space heating is being done in factories. The reason for this is largely bound up with the process-steam question, and until the "heat from steam for nothing" belief is exploded little can be done in electric heating. But where steam must be used for space heating electricity can result in vastly more efficient use. Well-designed ventilation schemes with electrically driven fans drawing air over batteries of steam coils at carefully selected points produce excellent results. Factory heating, however, is often something more than space heating. Specific local temperatures have to be maintained, constant or definitely variable, to assist in product conditioning or the prevention of condensation, and it is in this connection that the biggest claims can be made for, and unapproachable results achieved by, electricity. There is nothing to touch the precision, ease and flexibility of electrical control.

**Trends of Invention**

TAKEN in bulk, the activities of inventors may be regarded as tending to meet a public demand for certain types of apparatus. The report of the Comptroller-General of Patents shows that grid progress in 1931 has been accompanied by the devising of switchgear in which air or vapour blasts are used for quenching the arc (see our issue of May 22nd, 1931) and by the substitution of static for rotary converting plant. Electric discharge lamps for advertising and general illumination have received special attention. Inventors have also been busy with problems of communications. The latter include improved selectivity of wireless sets, the use of short wavelengths, automatic telephony, typewriting telegraphs, and television. Perhaps the most significant feature is the large number of inventions relating to synchronous motor-driven clocks, the most recent recruit to the small-current consuming devices that act as the thin end of the wedge in popularising electricity.

**Power Factor**

ONE cannot get very far in the theory of alternating current without coming up against trigonometry. Vector diagrams provide a good graphical method of presenting the characteristics of a circuit, and should be regarded as a sytem of shorthand for expressing what would otherwise take a great deal of space, with the help of algebra. We believe that, if either method were regarded merely as a useful tool for making clear the relation between current and voltage (and not as something having an occult significance of its own) more interest would be taken in power factor by men whose experience is primarily practical. The economic importance of a good power factor for an industrial power load is so great that the apathy towards the subject which is so often apparent seems inexplicable on ordinary engineering grounds. Are the supply authorities doing all that they might to encourage their consumers to eliminate wattless current?

# THE I.M.E.A. AT CARDIFF

The I.M.E.A. Convention opened at Cardiff on Wednesday afternoon with the issue of badges at the City Hall, where, as usual, we met many old friends. In the evening the president (Mr. C. G. Morley New) and the chairman and members of the Electricity Committee, supported by the Lord Mayor of Cardiff (Alderman C. W. Melhuish, J.P.) received the delegates and a dance followed. The number of delegates this year is 753, which, although smaller than usual, is considered satisfactory in present circumstances. Mr. J. W. Simpson, the secretary, told us that 326 persons signified their intention of attending the annual dinner on Thursday, and that the demand for tickets for the visits was well up to anticipations. The Convention promises to be as successful as any of its predecessors, although it is shorter.

## The Presidential Address. By C. G. Morley New

THERE are now nearly four hundred local authority electricity undertakings, on which £200,291,250 has been spent. The electricity supply companies' capital expenditure is £126,778,903, and the average yearly expenditures are £15,271,399 and £12,236,562 respectively. These figures indicate that local authorities have, as a whole, realised their moral obligations.

In 1929-30 some 2,649 kWh was sold per £100 of capital expenditure, the local authorities' figure being 2,715 kWh. Between 1922-23 and 1929-30 the men engaged in all sections increased by 25,261 to a total of 61,620, while the sale of energy per man employed rose by 35.9 per cent. to 104,636 kWh. Generation alone showed an increase of 100.7 per cent. to 462,360 kWh per man employed in the section.

It is not always wise to remain silent about our achievements. In fuel consumption spectacular savings have been effected. The consumption of fuel rose from 6.33 million tons in 1920-21 to 8.88 millions in 1929-30, an increase of 40.1 per cent. During that period the number of kWh generated increased from 4,154 to 10,082 millions (142.7 per cent.). At the same time, the average consumption per kWh fell from 3.4 lb. to 1.97 lb., or 42.0 per cent. There was thus an average saving of 1.43 lb. per kWh generated, equivalent to 6.44 million tons on the consumption for 1929-30 which, at 15s. per ton (the average was 15s. 5d. for 1929-30) gives a saving of £4,822,207; and this capitalised at, say, 8½ per cent. equals £56,731,847.

*[Elliott and Fry.*

**Mr. C. G. Morley New, this year's president**

### Offsetting Capital Charges

The latter figure might be compared with the total capital expenditure of £92,226,055 on plant and machinery at 1929-30, and £130,381,575, including buildings and other permanent works, when it will be seen that the annual charges on a large proportion of recent plant extensions are being met out of savings. At Cardiff the annual saving is some few thousands of pounds more than the total capital charges on the station. During the period 1921-22 and 1929-30 the average revenue received per kWh from consumers throughout the country was reduced by 48 per cent.

The foregoing represents rationalisation of a type which has much to commend it. It has been brought about by a continuance of personal control and friendly rivalry, and we should hesitate before introducing any further schemes for the better conduct of the industry if they entail impersonal control.

There is still room for lower operating costs, but not nearly the margin there was when the Act of 1926 came into force. Neither is there such margin between operating costs at medium size unselected stations and total cost at selected stations as to make it easy to close the former down at an early date.

Until recent years local authorities have been responsible for fully two-thirds of the total quantity generated and distributed to consumers. Of the 500 generating stations operated by authorised undertakings, 124 have been selected (more than double that anticipated in the Weir report), eighty belonging to local authorities, and forty-four company owned, whilst temporary arrangements are anticipated for some few years with twenty-two local authority and five company stations.

### Frequency Standardisation

If operation is carried out on the general lines now being pursued, generation will be about equally divided between company and local authority undertakings as to output, whilst on balance the company stations will operate at higher load factors and local authorities will be importing supplies. This may not be very comforting; but we need supplies at the lowest possible cost, no matter what the source, as our main duty is to give supplies to consumers at the lowest possible price.

Standardisation of frequency, together with a measure of standardisation of distribution, will be of immense benefit to consumers and must ultimately be to the advantage of the industry and justify its cost. If those undertakings which have carried out similar work out of their own resources have a grievance, it must be against those undertakings responsible for the non-standard plant, which fortunately only forms 20 per cent. of the total installed. So long as the present conditions obtain, local authority undertakings will be meeting the major portion of the burden. But they have nearly 60 per cent. of the total installed plant, with just over 15 per cent. non-standard, or a little over 2 per cent. if two large undertakings are excluded, whilst the companies have nearly 40 per cent. non-standard plant and about 23 per cent. after excluding one large undertaking. Between 1923 and 1930-31, consents to changes of system, &c., were obtained in 183 cases by local authorities and in 36 by companies, 20 of the latter being in 1930-31. One can only conclude that companies have different points of view from local authorities, and that it has been necessary to take national action to reconcile them.

The annual cost of the frequency change will in a few years reach nearly £900,000, or about four times what is now being levied for this purpose, and with the cost of the grid will constitute an addition to the fixed charges on the industry of an amount approaching £4,000,000 per annum.

Some 240 undertakings rely entirely on bulk supplies. The concentration of industries in ever-expanding populous areas is not altogether desirable. In course of time the cost of bulk supplies in any area should not vary much between one undertaking and another, so that medium and small-size undertakings should be in a much better position than they are to-day to negotiate for really large loads, although they

will be concerned in reconciling the bulk supply tariff with one acceptable to the prospective consumer, and it is here where the whole-hearted co-operation of the Central Board should be given.

Now, before the national scheme of generation is in operation, there are unmistakable signs of interest in distribution. It cannot be said that consumers in general have any desire for a material change from the conditions which now prevail.

The great necessity is for increased output to ensure success of the national scheme of generation, and this can only be obtained in the general interest by rousing those backward undertakers, both company and local authority, to a sense of their responsibility to the public; how this can be done presents a difficulty.

## The Organisation of Small Undertakings. By F. Newey

THIS paper outlines the organisation of a small electricity undertaking, *i.e.*, one with fewer than 5,000 consumers. The local authorities' power to sell fittings and apparatus (for connection to their own mains only) gives them unlimited scope and responsibility, but there is an unfortunate tendency for Town Councils to elect men to Electricity Committees without consideration for their ability to assist in the management of a trading concern. The Electricity Committee should consist of not more than twelve members, and much time can be saved by the appointment of a small sub-committee to deal expeditiously with the less important business items.

The municipal accountant should be responsible for the collection of electricity accounts, but they should be paid in the showrooms, so drawing consumers' attention to the appliances exhibited therein. Even a small undertaking cannot be managed successfully from an office chair; it should not be thought undignified to attend personally to the needs of the smallest consumer.

A small undertaking cannot afford a large highly paid staff; the principal assistants must therefore be versatile and possess initiative and the team spirit.

### Adequate Cables Essential

It is important to stress the need for laying adequate cables in an area which is being opened up. The cost of copper is small in proportion to the total cost of laying a main, and nothing smaller than 0.1 sq. in. distributors should be laid. All outside work should be scheduled well ahead and motor transport is now essential to carry men to and from their work. If they have to walk and push hand carts, their efficiency is impaired and cost increased. The laying of four-core service cables to all large houses to facilitate balancing is wise.

Meter testing and repairing are of increasing importance, since revenue depends on them to a large extent. The provision of history cards for all apparatus needing adjustment facilitates the tracing of faults. Slot meters can be calibrated to allow a small rebate when the money is emptied, as a set-off against probable shortage due to the insertion of false coins.

The repair and maintenance of apparatus are of increasing importance, and prompt attention to urgent calls is necessary. The service given in connection with small appliances results in the use of much additional apparatus. It is necessary to remember that the consumer looks for a "Service of Electricity," which must include attention to many small complaints, trivial to the undertaking, but of importance to the consumer. Good will is a great asset and a personal touch must be cultivated.

### The Commercial Department

The commercial department should keep a close check on all expenditure and revenue, for which purpose detailed information must be recorded. This department should be part of the showroom premises, where consumers normally seek information, and willingness to interview consumers should constitute part of the service rendered. It is a mistake to leave inquiries to be dealt with by a junior. Hire and hire-purchase transactions are frequently disputed, so that all agreements must be properly signed.

Three essential development factors are an attractive tariff, enthusiastic staff, and showrooms. A two-part tariff with a low kWh charge is essential and will ensure additional output, increased revenue, and effect a substantial saving in metering expenditure and accountancy.

Mr. F. Newey, who is electrical engineer at Long Eaton

Facilities should be provided for apparatus to be tested in the homes of employés, to give them confidence in their use and enable them to impart their personal knowledge and experience to intending purchasers and hirers, and speak with authority on cost of operation. New types should be fully tested, as failure of an appliance to function after being recommended will be discussed readily by consumers and will do the undertaking great disservice.

To stimulate interest in the progress of the undertaking the manager should set a definite objective, for if no ideal is before the staff no particular effort will be made. An increase of from 10 to 15 per cent. per annum in the kWh sold, together with one hundred extra cookers and five hundred new consumers, should easily be obtained by the majority of small undertakings.

### Importance of the Domestic Load

To-day electricity supply is a business for which a shop is essential, and a good display should be made; hire-purchase terms are necessary for the more expensive apparatus, on a three or five years' basis with a deposit of one-quarter the total cost.

Advertising is essential: demonstrations and visits to power stations are forms of publicity which are worth while, and the presentation of old apparatus to schools to be dismantled by the children enables them to acquire electrical knowledge which they will impart to their parents.

The domestic load will shortly represent the major portion of the outputs of some undertakings. It is quite safe, even in an industrial district, to estimate for a consumption of a minimum of 1,000 kWh per cooker per annum; "persons per cooker" is a better guide to development than the number installed.

The extension, and a better standard, of street lighting is worth considering and many shop windows in small towns are badly lighted. A two-part tariff does not appear to be equitable for shopkeepers when diversity of trades demands different standards of lighting. A high m.d. charge with a low running charge is more likely to induce them to make better displays.

An appendix to the paper contains a variety of examples of record cards.

## Public Lighting. By J. N. Waite and W. J. Jones

STREET lighting should be adequate or not attempted at all. Adequate illumination can be provided at very little extra cost over that of poor lighting.

The public is the final judge: an installation which enables citizens to see properly is a good one, even though it may transgress many accepted principles of the lighting expert. In the majority of instances it would be possible for towns and boroughs to obtain better illumination by electricity than by gas, and at a lower cost.

The gas industry makes great use of partial truths in its propaganda. The present paper contains comparative data and conclusions in an authoritative form, and representative examples of the cost of electric street lighting.

### Electricity's Rapid Strides

Electricity used for street lighting increased from 49.5 million kWh in 1922 to 144 million kWh in 1930, while the revenue grew from £597,500 in 1922 to £967,700 in 1930, in spite of the fact that during that period there was a reduction of the average price charged for electricity for street lighting of 45 per cent.

A questionnaire sent to supply undertakings indicates that of 618,235 street lamps in their areas no fewer than 263,770 are electric, representing 43 per cent. of the total. The replies received from 276 undertakings show that during last year they were responsible for electrically lighting 490 miles of new streets, and converted 400 miles of streets from gas to electric lighting.

The time is peculiarly opportune for expansion, since the rapid extension of mains and the growth of suburban areas offer opportunities which, if lost now, will not recur for some considerable time. The gas industry is making a determined effort to remain in the field.

There is a tendency in too many instances when conversions are taking place from gas to electricity to provide a similar amount of light. It is preferable to offer a substantially increased amount of light at a similar or little higher cost. The public will be quick to respond to the improvement effected, and electricity will earn added prestige.

### Need for a Low "Unit" Charge

In view of the high load factor and other favourable characteristics of the public lighting load, the first essential to real progress is a reasonably low "unit" charge for electricity. One of the authors has found it possible to undertake public

Mr. W. J. Jones, M.Sc., manager of the E.L.M.A. Lighting Service Bureau

lighting remuneratively with a "unit" cost not exceeding ¾d. per kWh for all night lighting. In the case of high wattage lamps there are good reasons for suggesting that an even lower charge could be justified.

It is advisable to quote public lighting authorities an inclusive charge per post per annum, according to the size of lamp and according to the number of hours operation. Such a procedure is more readily understood by Lighting Committees, and is the basis on which rates are levied. The fact that the aggregate cost of operating a street lamp for all-night service is very little more than that from dusk to midnight should be stressed.

The better the standard of lighting the lower is the cost in proportion. Nothing less than 100 watts per post is adequate in urban areas. Lamps of this size give not less than 17.7 per cent. greater light throughout their life than their predecessors of 1924. Pearl and opal lamps give more light with less glare than gas mantles; highly directive gas equipment is liable to produce glare, and in Bradford complaints are already being made. The authors indicate the lines on which they consider that correlation is needed in future issues of the British Standard Specification for Street Lighting.

They conclude that so great are the economic advantages of electric public lighting that in the majority of instances the capital expenditure involved in the conversion of gas-lighted streets when spread over a period of from ten to twenty years is a good investment.

Mr. J. N. Waite, M.I.E.E., city electrical engineer of Hull

## The President-elect

MR. GEOFFREY PORTER, who is to succeed Mr. Morley New as president, was born in 1874, and has been borough electrical engineer at Worthing since 1901, when he supervised the installation of plant and mains prior to the inauguration of the supply in September of that year. Since 1905 the whole of the work of the undertaking has been carried out to his specifications and under his personal supervision.

His name in the profession is closely connected with the development of the Diesel engine for the production of electricity. He was among the first to appreciate the advantages of this type of prime mover in appropriate conditions, and as long ago as 1910 recommended its adoption at Worthing. Since then he has removed the whole of the steam plant in favour of heavy-oil engines with happy results. The sets now installed range in capacity from 125 to 785 kW, aggregating 2,920 kW. A bulk supply has been received from the Central Board since 1927.

Mr. Porter has always been generous in placing his valuable operating experience at the disposal of his fellow engineers. He was one of the founders of the Diesel Engine Users' Association—a body to whom the publication of most valuable data has been due—and has served four times as its president, and read six papers before it.

The paper on "The Heavy-oil Engine and its Application in Electricity Supply Undertakings," which he delivered at the Torquay Convention of the I.M.E.A. three years ago, covered the ground in a masterly manner, and at the Centenary of the Institution of Civil Engineers, of which he has been an associate member since 1902, he was invited to contribute a short paper of a similar character.

Mr. G. Porter, president-elect of the I.M.E.A.

Mr. Porter's attention has by no means been confined to internal-combustion engines, as his record of development at Worthing shows. Compensation for the lack of industrial load in the town has been obtained by a progressive policy (inaugurated in 1925) in extending the supply into villages in the neighbouring hinterland by means of 11-kV transmission lines. Development has been mainly in domestic uses, both in and outside Worthing, and in this way the output has been increased from slightly over one million kWh in 1926 to nearly ten million kWh in the year ended last March.

Mr. Porter received his technical training in Germany. On leaving Berlin he entered the service of the P. & O. Steam Navigation Company. In 1927 he received an appointment on the staff of the Westminster Electric Supply Corporation and gained much useful experience in every kind of breakdown that an enthusiastic young engineer could desire at the old power stations at Eccleston Place and Davis Street.

His present activities include membership of the council of the Electrical Research Association, but his principal extra-official work has been in connection with the I.M.E.A., of which he has been member of council for some eight years, and has acted as chairman of committee. He was elected vice-president last summer at the Scarborough Convention.

## Among Those Present

The company assembled at Cardiff includes the following well-known members of the electrical industry :—

A. J. Abraham (Bexley), H. Adam (Seaham Harbour), W. E. Affleck (Guildford), C. T. Allan (South Wales E.P.D. Co.), S. T. Allen (Cen. Elec. Board), E. A. Anderson (Walton-on-Thames), H. W. Angus (Eccles), H. E. Annett (Bolton), N. Appelbee (Ashton-under-Lyne), A. Aspinall (Brighouse), Ll. B. Atkinson (C.M.A.), F. Ayton (Ipswich), W. J. Bache (Cheltenham), A. W. Barham (Watford), Major E. A. Barker (Barnsley), J. A. T. Barnes (Kendal), E. G. Batt (G.E.C.), Capt. A. J. Beckett (Bridlington), J. Beckett (M.T.T.A.), Major H. Bell (Glasgow), J. Alex. Bell (Aberdeen), W. C. Bexon (Ayrshire Elec. Board), A. Bishop (Buxton), D. H. Bishop (Dundee), H. E. Blackiston (Ipswich), A. S. Blackman (Sunderland), G. M. Blackmore (Stanley), A. W. Blake (Willesdon), T. Bloore (Sutton Coldfield), F. A. Bond (Battersea), J. H. Bowden (Poplar), J. M. Bowman (Rhondda), A. L. Boyle (Scunthorpe), W. D. Brassington (Motherwell), H. Breckell (Gainsborough), S. E. Britton (Chester), G. Broadhurst (Clacton-on-Sea), Sir John Brooke (Electricity Commission), E. Brunt (Todmorden), J. K. Brydges (Eastbourne), H. R. Burnett (Barrow-in-Furness), J. W. Burr (Swansea), H. C. Busbridge (Swinton), A. Q. Carnegie (C. A. Parsons & Co.), H. F. Castle (Bridport), J. V. Chaplin (Colwyn Bay), John Christie, A. W. Clegg (Accrington), P. Clegg (Haslingden), S. Clegg (Lincoln), T. M. Climie (Falkirk), W. N. C. Clinch (Brighton), C. A. Coleman (Turton), O. G. Cook (Bingley), W. H. Cooke (Luton), H. Coope (Met. Vick.), W. J. Cooper (Hamilton), F. H. Corson (Gloucester), H. W. Couzens, C. H. Cox (Edison Swan), Alex. C. Cramb (E.D.A.), E. Cross (Rotherham), V. W. Dale (E.D.A.), B. Darby (Atherton), Major E. Ivor David, C. S. Davidson (Barnes), D. H. Davies (Chesterfield), H. C. Day (Heywood), G. P. Dennis (G. P. Dennis, Ltd.), A. J. C. DeRenzi (Newcastle-under-Lyme), J. W. Dodds (E.W.F.), Capt. J. M. Donaldson (North Met. E.P.S. Co.), Sir A. R. Duncan (C.E.B.), D. N. Dunlop (B.E.A.M.A.), A. H. Dykes, J. Edgar (South Shields), J. E. Edgecombe, F. H. Edwards (Dartford), A. Ellis, H. Ellis (West Gloucestershire P. Co.), J. E. Ellis (Morley), F. F. Elliott (Woolwich), W. Elliott (Edison Swan), W. H. Elliott (East Ham), G. J. Evans (Pontypridd), Capt. G. F. Falk (Falk, Stadelmann & Co.), W. K. Fleming (Rothesay), F. Forrest (Birmingham), J. S. Forster (Crook), S. H. Fowles (Loughborough), W. Frisby (Colchester), A. J. Fuller (Fulham), C. Furness (Blackpool), Sir Francis Goodenough (I.E.S.), C. E. D. Greenhalgh (Ilkley), G. F. Gregory (Ilford), E. Grime (Grays), J. W. Hadfield (Barnstaple), H. Hall (Gillingham), T. Hall (Burton-on-Trent), B. Handley (Portsmouth), R. C. Harpur (Dover), S. B. Haslam, Miss C. Haslett (E.A.W.), B. T. Hawkins (Wallasey), H. J. Herrera (Risca), E. H. Hewlett (Mansfield), T. W. Hibbert (Doncaster), W. C. B. Hillman (Caerphilly), E. E. Hoadley (Maidstone), W. E. Hobbs (G.E.C.), Frank Hodges (C.E.B.), Major L. B. Hogarth (Whitehaven), G. J. Hollyer (Torquay), J. Hopton (Normanton), A. J. Howard (Taunton), H. A. Howie (Walsall), J. B. Hudson (Leigh), A. J. Hutchinson (Farnworth), W. A. Jackson (West Bromwich), E. J. Jarvis (Scarborough), E. J. Jennings (Birmingham), A. C. Johnson (Southend-on-Sea), C. M. Johnston (Shrewsbury), W. S. Johnston (St. Helens), B. Jones (Bedwellty), E. W. Jones (Mountain Ash), W. E. Jones (Basingstoke), W. J. Jones (E.L.M.A.), A. L. Keet (Exeter), T. A. Kerr (Stretford), W. E. Kidner (Barking), T. A. Kingham (Kingston-upon-Thames), D. M. Kinghorn (Southwark), J. D. Knight (Ealing), A. E. Knights (Bury St. Edmunds), W. C. Knowles (Elland), G. H. Lake (Nottingham), H. C. Lamb (Manchester), J. Lambert (Perth), H. Large (Stoke Newington), J. Leadbeater (Hampstead), R. Lee (St. Pancras), J. T. H. Legge (Shrops, Worcs and Staffs E.P. Co.).

(*Continued on p. 910.*)

# The Choice of a Factory Site. By Harold Leopold Farmer*

## The extent to which electrical supply enters into the problem

FACTORY questions to-day include, in a prominent position, the availability of a cheap supply of electrical energy; and so far as the ELECTRICAL REVIEW is concerned, works which are not to depend upon this for their power, as well as for other services, do not come within my scope here. Of course this is only one of the factors which have to be considered; and before dealing with it in detail, it will be well to review briefly the chief points which enter into the selection of a site for manufacturing purposes, so as to form some idea of the weight which should be given to each.

The mere cost of the land itself, without taking into account the requirements of the particular purpose for which it is wanted, is a small matter. A very low-priced site might be dear at a gift; while even one with certain advantages about it might be dear for one type of works although a bargain for another.

### Mere Cheapness of Land Not Enough

The governing principle in settling the position of any works must be its geographical situation in relation to its capacity to obtain what it requires both in material and labour, and to distribute the finished product. The cheapness of a site is nothing unless its suitability in these respects is satisfactory. Low-priced land is often outside a matured local authority's jurisdiction, and if ultimately it is taken over this will only be done at much expense. It may be without many of the necessary amenities—not electricity alone, but a water supply, sewerage, means of dealing with factory effluent, &c.

On the other hand, although they may meet these requirements, large towns are not always the most suitable; and there are many less strictly urban areas where most of the advantages of a large town are still available, at a less cost and with other points in their favour. One of these, one which is most frequently overlooked until it is too late, is the opportunity of providing at a low first cost not only for such ordinary expansion as can be plainly foreseen and hoped for, but for an increase altogether beyond this which may be needed either from unexpected growth of business, or from the necessity of making some of the material which until then has been bought in a manufactured state. Everyone in business can recall cases of this kind, when it would have been sound finance to get property adjacent to the site when it could be done cheaply, even if it was at once let off again. City sites often impose limitations in this direction which may be disregarded at first, but which in the long run necessitate a removal of the entire undertaking at a capital expense very many times as great as the cost of the extra land at first.

### The Chief Factors in Order

Generally speaking, under average conditions, I should arrange the value to be attached to the various factors which influence the selection of a site in the following order:—

1. Availability of the type of labour required.
2. Local rates and assessments.
3. Electricity, coal, oil-fuel, water supply and sewers.
4. Transport facilities—by rail, road and water.
5. Cost of living in the district.
6. Pure air and healthy surroundings generally, with accommodation for the housing and recreation of those working.

Labour must be one of the prime factors. Many costly and elaborately equipped works have gone into disuse from sheer inability to secure labour of the kind required in sufficient quantity. When the quantity does not vary much from time to time the difficulty of providing it is lessened; but when there are great variations the value of the nearness of a big population to provide a pool from which it can be drawn is emphasised. The existence of other factories of a kindred character, or with which the sort of labour required is interchangeable, may be an inducement. On the other hand, female labour may be most easily obtained when there is little other demand for it, provided there is a general population from which it can be drawn.

Rates do not count for so much as they did, owing to recent legislation; but they have to be taken into account nevertheless, and they enter into the question of the cost of living also. When rates in different areas are compared, the services which they cover must be regarded before the comparison can be fairly made.

### Transport: Speed as Well as Cost

The character of the products and of the materials employed influences the value which is to be put upon transport facilities. When the goods to be handled are not heavy, there arises at times the matter of rapidity of transport; and the nearness of a railway station with express services to the great centres may count for much more than the rates per ton on materials and products. The alternative of road haulage has made rail transport less important than it used to be. In any comparison of its costs with railway charges a factor which is sometimes ignored is the reduction in packing costs and in damage in transit which usually accompanies the direct factory to warehouse or consumer transport which is possible by road.

The cost of living in the district may be coupled with the availability of labour; and allied to both, of course, are the subjects of surroundings, fresh air and recreations. The whole tendency to-day, and a right one if it is not overdone, is to give full weight to the benefits which are obtained from ample spaces, pleasant and beautiful surroundings and ample opportunities for recreation. Put at the lowest, these have a real commercial value. Moreover, in some manufacturing operations, the processes themselves call for pure, dust-free air.

### Electricity from 5 to 20 Per Cent.

While the value to be put upon electrical power necessarily varies in comparison with the other items, according to the particular trade concerned, I have no hesitation in saying that in my experience what has been frequently referred to as the availability of "a cheap and abundant supply of electricity" has a very vital bearing upon the choice of a factory site. That value will depend largely upon the proportion which the cost of power bears to the final price of the completed product.

In many industries this proportion may not exceed five or six per cent. Even then its effect may be far from negligible, since a very small difference in manufacturing costs may make all the difference between an order being obtained or lost. At the other end of the scale are manufacturing processes, such as those in the production of aluminium and in certain chemical operations, where the power employed mounts up to one half or even more of the total cost of production; and in these special cases the availability and cost of electricity are deciding factors in settling the position of the factory.

The advertisements put out describing the advantages of various areas as factory sites rightly enough lay stress upon the availability of electricity at low rates. They recognise that the cost of power is one item which varies with the output; so many of the other costs being of the nature of fixed charges. Nor is it merely a matter of the cost per unit of the power consumed.

Modern industrial undertakings are depending more and more for the reduction in costs upon the efficient and economical application of the power used; this implies a ready and direct means of measuring accurately the energy taken in each separate manufacturing operation, so that waste can be detected at once, and the possibilities of economies can be shown. It is here that electricity scores heavily over all its competitors.

### Electricity's Claim

Electricity makes a strong claim also from the ease with which it can adapt itself to the demands made upon it. Just as provision for expansion is important in site area, so also is it important in the power supply. With all other competing sources of power there is a definite limit to the power which can be taken, and when this limit is exceeded, expensive and bulky additions may have to be undertaken to provide for such expansion. When electricity is taken from one of the large sources of supply there is no limit within reason to the power which can be taken as the need for it becomes greater.

This brings me to the last aspect of my subject, the alternatives of a public supply or a self-contained generating station. My experience is that the manufacturer generally would prefer to leave the supply of electricity to the experts, provided always that they make it economically sound for him to do so. Such specialised matters as the requisite provision for adequate supplies of fuel-oil, coal, water, &c., are often quite outside his experience, without taking into account the space occupied and the provision of proper reserves to meet temporary shortages brought about by industrial disputes or other contingencies quite outside his control. Then there is the flexibility of a public supply, specially valuable when it is difficult to foresee what may be the power requirements in the future. Last, and with many first also, is the demand the self-contained plant makes for capital when all that can be got is required for the factory itself.

* Mr. H. L. Farmer is a partner in the firm of Leopold Farmer & Sons, which has had some 50 years' experience of factory property all over England.

# Private or Public Supply? By Kilovar

## Some considerations for the manufacturer's attention

THE manufacturer laying out a new works turns, in most cases, automatically to the public electricity supply undertaking as the natural source of power; it is probably exceptional for serious consideration to be given to the alternative of installing private power plant. Nevertheless, the power tariffs of authorised undertakings still vary so widely that in the less advanced areas manufacturers are sometimes forced to ask themselves, "What exactly is a public supply of electric power worth?"

This question may be answered by comparison with the results obtainable with private plant, provided that due weight is given to the following considerations, which do not lend themselves to numerical estimation, but which vitally affect the prosperity of the business for which the power is required.

Reliability is of crucial importance in almost all industries. It is frequently not considered feasible to include stand-by plant in a private installation, but obviously power from this source does not equal in value a public supply backed by adequate stand-by plant and a system of interconnected generating stations and mesh distribution which offers the utmost attainable security of supply.

### The Drawbacks of Private Plant

The installation of private power plant either limits the extension of power processes in the factory, with its consequential increase in output per employé, or necessitates the locking up of capital in the provision of excess power plant capacity before the date when it is needed. A public supply can be drawn upon and paid for only to the extent to which it is required each year, thus not only facilitating extension of power processes, but mitigating the burden of overhead charges during periods of slack trade.

The installation of private plant precludes its owner from benefiting from further improvement of efficiency within the estimated economic life of the plant, except at a sacrifice of capital. His power costs will tend to rise as the efficiency of his plant diminishes with age, and repairs and maintenance increase. Production costs of public supply authorities are, on the other hand, being steadily reduced, and every new consumer contributes to and shares in the increasing economy.

Private power plant often takes up valuable space on a factory site which can more profitably be employed for manufacturing processes. The necessity to raise additional capital for the provision of power plant, quite apart from the question of interest (which is touched on later) often restricts the manufacturer's credit, making it more difficult for him to finance his principal business.

### Advantages of a Simple Contract

With regard to the cost of power, the only safe basis of comparison is a complete estimate of all annual charges properly associated with the power supply for each proposal. The main or sole item of cost of a public supply is based on a simple contract, while the alternative involves the estimation of capital and operating charges appropriate to an undertaking of a nature widely different from the main business of the factory, although rigidly linked to it. Hence the following considerations govern the preparation of estimates:—

If, instead of concentrating solely on the running of his factory, the manufacturer adds a subsidiary industry—the production of power—he should debit that industry with its fair share of management and general establishment charges, rent, rates, taxes, and insurance.

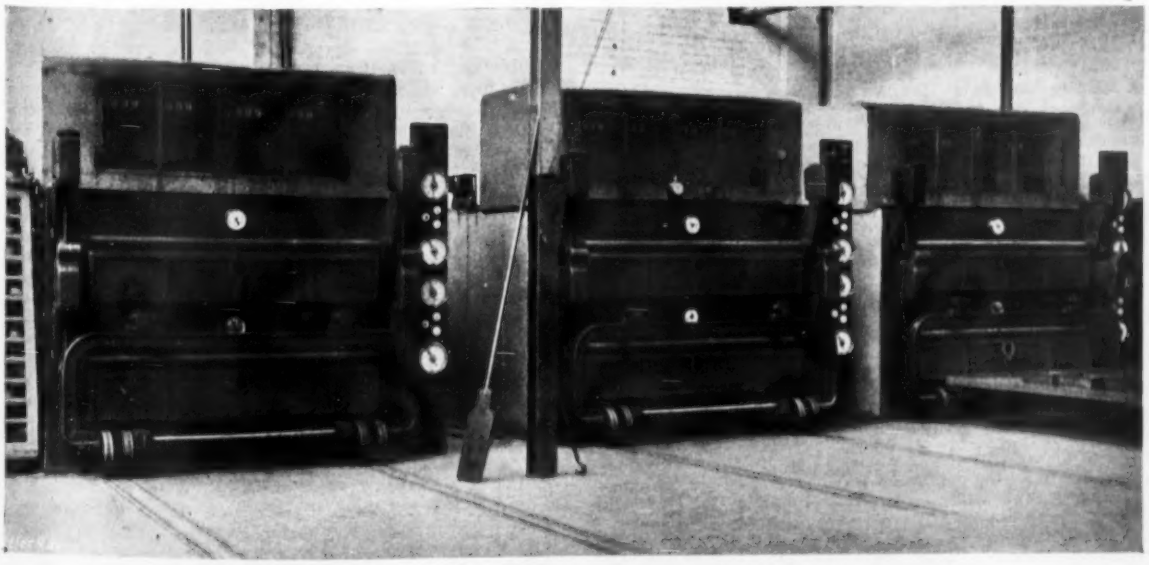
The appropriate rate of interest or profit to be brought into the estimate is only remotely affected by the bank rate, and should be assessed at a figure adequate to attract new capital into the business for which the power is required.

Depreciation depends mainly on the type of plant installed and the conditions of service, but the useful life of private plant ends when it no longer serves its original purpose efficiently; it cannot be relegated to peak load duty as can central station plant.

The estimates of operating costs must be based on industrial experience over a reasonable period of years and not on test figures and plant manufacturers' forecasts.

While the cost of power production by independent industrial plants must vary with their size and load factor, and with other operating conditions governed largely by the industrial process itself, so that each individual case must be investigated in detail, the following estimates may be of interest as showing typical examples of the total annual power costs which may reasonably be expected in average cases. In three examples heavy oil engines are considered and in the fourth a steam turbine set; stand-by plant is included in "C" only.

| | Example A. | Example B. | Example C. | Example D. |
|---|---|---|---|---|
| Generating plant installed | 1–25 kW semi-Diesel | 1–200 kW Diesel | 4–335 kW Diesel | 1–1,250 kW Turbine |
| Stand-by plant included | Nil | Nil | 1 set | Nil |
| Maximum demand .. | 25 kW | 200 kW | 1,000 kW | 1,000 kW |
| Average load .. .. | 12½ kW | 125 kW | 750 kW | 750 kW |
| Total working period p.a. | 2,400 hrs. | 2,400 hrs. | 2,400 hrs. | 2,400 hrs. |
| Output to factory p.a. (kWh) .. .. | 30,000 | 300,000 | 1,800,000 | 1,800,000 |
| Annual load factor .. | 13.7% | 17.1% | 20.5% | 20.5% |
| Station consumption p.a. (kWh) .. .. | 1,000 | 10,000 | 40,000 | 100,000 |
| Total kWh generated p.a. | 31,000 | 310,000 | 1,840,000 | 1,900,000 |
| Running plant load factor % .. .. | 52 | 65 | 76 | 63 |
| Fuel consumption, lb. per kWh .. | 0.80 | 0.68 | 0.66 | 2.40 |
| Total fuel consumption, tons p.a. .. .. | 11 | 94 | 542 | 2,036 |
| All-in cost per ton .. | 90/- | 80/- | 75/- | 20/- |
| Total capital expenditure | £900 | £4,000 | £25,000 | £20,000 |
| Rate of interest (or profit) | 7½% | 7½% | 7½% | 7½% |
| Rate of depreciation .. | 7½% | 6½% | 6½% | 5% |
| Total capital charges .. | 15% | 14% | 14% | 12½% |
| *Annual Costs* | | | | |
| Capital charges .. | £135 | £560 | £3,500 | £2,500 |
| Establishment charges | 20 | 70 | 350 | 280 |
| Fuel .. .. .. | 50 | 376 | 2,033 | 2,036 |
| Oil, water, and stores .. | 12 | 70 | 350 | 150 |
| Wages (running and routine maintenance) | 125 | 250 | 800 | 650 |
| Overhaul, repairs, and renewals .. .. | 30 | 120 | 520 | 320 |
| Breakdown insurance .. | 15 | 50 | 250 | 100 |
| Total annual cost .. | £387 | £1,496 | £7,803 | £6,036 |
| Cost per kWh supplied to factory .. | 3.10d. | 1.20d. | 1.04d. | 0.80d. |



A bank of six 32-kVA cake ovens at the factory of Messrs. Hughes and Co., Birmingham

Interest on capital is arbitrarily assessed in each case at 7½ per cent. No general figure can be given, and on the principle enunciated above the appropriate rate may easily vary from 6 per cent. to 10 per cent. The rates of depreciation shown are appropriate to favourable conditions with single-shift working as normal. Higher rates are advisable for oil engines with longer running hours, but turbine depreciation is not much affected thereby. Buildings are sometimes assessed separately at lower rates, but this is a questionable policy as it is by no means always possible to use such buildings for other purposes when the power plant is superseded.

Establishment charges comprise ground rents and rates peculiar to the power plant, supervision of labour, and a share of general overhead charges, including office rent and rates. These should clearly be estimated in the same manner as that in which such charges are allocated to the products of the factory. There is no fixed relation between these items and capital expenditure, but in the absence of other data they are frequently assessed between 1 per cent. and 2 per cent. of this.

In estimating the cost of oil fuel a reasonably long view should be taken. Present oil prices are recognised to be below an economic level, and there is a strong probability of a duty being imposed both to protect coal and as a tax on motor vehicles using heavy oil. Other running costs, comprising lubricating oil, water and stores, salaries and wages, repairs and maintenance, are the subject of much controversy.

The prudent manufacturer will find valuable evidence of the costs actually incurred in generating stations, under the heading of "Other costs," in the returns published annually by the Electricity Commissioners. Very useful information is also contained in the reports of the Diesel Engine Users' Association. It is sometimes claimed that "other costs" are lower for private plant than for public generating stations, because the former is run only during the working hours of the factory, giving a much better load factor during those hours.

The criterion, however, is the running plant load factor, which investigation shows is, in general, no better in private stations than in public supply stations, and the recorded costs of the latter, if intelligently used, afford reliable data for the estimation of private power costs.

# Industrial Heating in the Potteries

THE materials employed in the production of pottery—clay, stone, flint, &c.—are not found in Staffordshire but are brought from distant parts of the country, Cornwall being a particular source of clay, while flints are even imported from the south of France.

Three essential requirements have caused the pottery industry to settle in the Stoke-on-Trent area: marl, a local clay, is used for the saggars, somewhat crude earthenware containers in which the pottery receives its initial baking in coal-fired kilns; cheap coal—the district is, of course, a mining one; and cheap labour. How far electricity can or will enable the industry to develop in other parts of the country is, perhaps, a matter for speculation, but there is no doubt at all

**A "Moore-Campbell" kiln in the Empire Porcelain works**

that it is helping greatly in the locality, and that it holds out a much greater promise for the not too distant future.

There are three essential heating operations in pottery work. The clay formations have first to be subjected to temperatures of between 1,000 and 1,350 deg. C.; the glazing, after dipping the fired bodies, is heat treated at from about 900 to 1,100 deg. C.; and the decorations are fired at between 600 and 900 deg. C.

It is in connection with the last mentioned operation that electricity has made its mark. Before a start could be made cheap electricity had to be assured, and credit is due to Mr. C. H. Yeaman, city electrical engineer, Stoke-on-Trent, and his department for the way in which they have met this requirement. Electricity is available for continuous firing operations at from 0.5d. to 0.375d. per kWh, according to the installation load factor. We understand that 88 per cent. load factor is necessary for a consumer to secure the best supply terms, but in all the potteries we visited over 90 per cent. was the rule. At the works of Messrs. Doulton & Co., Ltd., the weekly, monthly, and yearly average load factors are 93, 92.5, and 90 per cent., respectively, holidays being included in the yearly figure.

But although cost is of primary importance, and all the pottery men we saw reported an overall saving from the use of electricity instead of coal for firing, including fuel, maintenance and repairs, and labour costs, they are all more concerned with the vastly superior production under the modern firing method. The coal-fired kilns replaced by electrical equipment are actually muffle furnaces, and firebrick leakages led to sulphuring (slight discoloration of the surface) of the pottery. The same trouble is experienced, to a lesser extent, with gas-fired kilns. Mr. H. E. Wood, Doulton's works manager, said he had not had a piece of sulphured china since his electric kiln was installed and put into continuous operation three years ago. During that time the cost for repairs and maintenance had been negligible. The ease of electrical control is naturally stressed by all who employ electricity.

Nine of the largest potteries have electric kilns installed, and they are all one of two types and makes. There is the "Moore-Campbell" kiln, developed jointly by Major B. J. Moore and Major A. J. Campbell, now both of Messrs. Mintons, Ltd., and manufactured by Messrs. Gibbons Bros., Ltd., and the "Efco-Doulton," a joint development of Messrs. Doulton's and the Electric Furnace Co., Ltd., and made by the latter company. The "Moore-Campbell" furnace consists essentially of a tunnel through which a train of specially designed trucks carrying the ware moves continuously at a rate dependent on the output required and the electrical loading. At the centre of the kiln a series of specially moulded refractory insulating blocks carry a number of heavy spiral resistor elements so that they are able freely to expand and contract in all directions. The elements will operate safely at temperatures up to 1,000 deg. C.

## The Nature of the Kilns

We saw one of these kilns at the pottery of the Empire Porcelain Co., Hanley. The overall dimensions are 5 ft. 6 in. wide, 5 ft. 3 in. high, and 100 ft. long, including the drying chamber at the exit end and the truck-propelling gear at the entrance end. At one side of the kiln is a pair of rails along the whole length, and this demands another 3ft. 4 in. on the width of the complete equipment. The actual tunnel measures 17 in. wide by 3 ft. 10 in. high.

The firing chamber is about 26 ft. long, in the centre, the ware being gradually heated up and cooled off in the extensions at the front and back ends, respectively. From the inside of the tunnel outwards the construction of the sides is 4½ in. firebrick, 4½ in. insulating brick, and then insulating powder fills the space to the 9-in. outside wall. The top construction is exactly the same, except that there is no outside wall. The bottom is of reinforced concrete. Rails carry the trucks inside the chamber, of course, and they have special expansion joints.

There are twenty elements in the actual firing section—ten on each wall. The resistor coils are about 1¼ in. in diameter, and through them are threaded triangular sectioned lengths of earthenware which are supported horizontally on bearers protruding from the walls. The ten elements on each wall are arranged in three banks, one of six vertically at the exit end of the chamber and two others of two elements each in line with the bottom two of the larger bank. Each element on one wall and the corresponding one on the opposite side are connected in one circuit, the ten circuits being brought out to d.p., "M.E.M." ironclad switch-fuses. These units are supplied from the bus-bar chamber above, phase to neutral (240 U), and are balanced over the three phases. Each phase was loaded to about 85 A when we saw the kiln.

Three thermo-couple devices projecting into the heating

chamber from the top are connected to a " Cambridge " temperature recorder. They read 320 (entrance), 500 (centre), and 700 deg. C. (exit). A fourth couple at the hottest end is connected to a temperature regulator. At the back of the red (setting) pointer is a small heater, and at the back of the black (temperature indicating) pointer is a small thermo-couple. When the couple is immediately over the heater (both pointers at the same scale reading) the couple becomes energised and operates a relay which in turn operates solenoid contactor gear and puts a section of the elements in or out of circuit.

The electrically driven propelling gear is rack operated, the ramrod being just long enough to deal with one truck length, the train of trucks pushing end on end. By an arrangement of cone pulleys the rate of travel of the trucks can be varied from three to nine feet per hour. An auxiliary cut-out definitely switches off the driving motor when the leading truck arrives within a few inches of the exit door of the kiln.

Mr. Holland, of the Empire Co., told us that, so far as could be judged from his two years' experience of the kiln, the overall running cost with electric working was about half that of the coal-fired kilns of the same capacity. There was not so much heat variation as with coal, and heat was not wasted on the continuous running due to cooling down of the kiln. At Messrs. Minton's we saw two furnaces of this kind, one a small model on which the original experiments and trials were carried out. This is still in use, and the operatives spoke very highly of it. Both this and the larger one, with minor modifications, are similar in practically all respects to the one described.

**The propelling gear of a " Moore-Campbell " kiln; a truck of pottery entering the tunnel**

## Some Actual Results

The following data was obtained from the " Moore-Campbell " kiln at the pottery of Messrs. J. & G. Meakin, Ltd., Hanley, and represents the heat balance for an average loaded truck of earthenware.

| | lb. |
|---|---|
| Total weight of iron per truck | 480 |
| " " " clay bobbins | 20 |
| " " " ware | 205 |
| Heat content of iron, B.th.u. | 94,978.56 |
| " " " clay bobbins, B.th.u. | 6,400.96 |
| " " " ware, B.th.u. | 65,609.84 |
| Total heat content, B.th.u. | 166,989.36 |
| Theor. electric consumption, kWh | 48.9 |
| Actual " " kWh | 51 |
| Kiln efficiency | 95% |
| Electricity consumed per kiln dozen, kWh | 2.32 |
| " " lb. of ware, kWh | 0.25 |
| Cost of electricity per kiln dozen at ½d. per kWh | 1.16d. |
| " " " " lb. of ware at ½d. per Kwh | 0.125d. |
| " " " " kiln dozen at ¾d. per kWh | 0.855d. |
| " " " " lb. of ware at ¾d. per kWh | 0.087d. |

In broad principle the " Efco-Doulton " kiln is similar to the " Moore-Campbell " one, but it accommodates two trains of trucks moving side by side in opposite directions, between which at the actual firing section is a high dividing wall 12 ft. long and carrying elements on either side, with a lower wall extension at each end. The outside wall elements are not exactly opposite each other. On each side they extend over a 26-ft. length of wall, the exit end of which on each side is in line with the exit end of the 12-ft. length of element-carrying partition wall. Doulton's regard each tunnel as a separate kiln. The nickel-chrome spirals (about ¾ in. in diameter) are threaded through grooves at the face of the fire bricks (" quarries ").

Each phase supply is given by a separate phase to neutral tapping transformer, by which the voltage can be varied in setting (not in operation) from 195 to 245. The automatic regulation (" Cambridge ") is the same as that employed for the other type of kiln, but there is a separate regulator for each tunnel. There is no fuse control on the elements, but the main " Ellison " oil circuit breaker is fitted with an overload release on each coil. The elements are balanced across the three phases. A thermal fuse in the top of the chamber is arranged in the no-volt connections of the main circuit breaker.

In normal running about 60 per cent. of the elements is in circuit. Variations between the tunnel temperatures are practically nil. Half-hourly readings of the two pyrometers over a 13-hour night period vary from 782 to 785 deg. in one case and from 791 to 793 deg. in the other.

The firing dimensions are 2 ft. 6 in. high by 1 ft. 3 in. across (each tunnel), and the total length of the kiln is about 120 ft., including the accommodation of the propelling gears—one at each end. Mr. Wood said that within limits the length of the kiln is not material, because the whole operation depends on the truck speed and the electrical loading. With a longer kiln and the same loading the same results might be obtained by speeding up the trucks. A kiln could be built half the length, but not for the same output.

The kiln in question has a maximum rating of 100 kW, and the average reading on the phase meters was about 125 A. The trucks were timed to pass into the kiln every 57 min. Pottery for both under-glaze and over-glaze decoration firing was being passed into the equipment. Speed variation on the propelling equipment is effected by wheel and disc friction gear, the speed of the driving wheel bearing on the plane surface of the disc varying according to its distance from the centre of the disc. The pusher speed can be varied from half an hour to one and a half hours per truck length.

## Distribution of Heating Elements

At the outset there was some difference of opinion between the electrical and the pottery people concerned as to heat disposition in the tunnels. Experience has proved that the heat imparted is not wholly radiant, and it has been necessary to modify the loadings so as to have them greater at the bottom of the tunnel. The result of this is more clearly marked in a kiln of the same type at the pottery of Messrs. Wood & Sons, Ltd., Burslem. The loadings are graded from nearly the top to the bottom. In this equipment one three-phase tapping transformer is employed for the voltage setting, as against three single-phase units. The housing and construction of the elements are the same, and so are the temperature-regulation arrangements. This kiln is a few feet shorter than that at Doulton's, because there was less room available. The truck speed was one per hour.

Mr. Wood (Doulton's) is confident that the next step in electric pottery firing will be for glazing; indeed small kilns are already in operation for this purpose in Sweden. Elements are now available to operate at 1,350 deg. C., so that initial electric firing for the clay is quite possible. An interesting aspect is that some of the pottery people whom we met seemed more hopeful of this possibility than some electrical men.

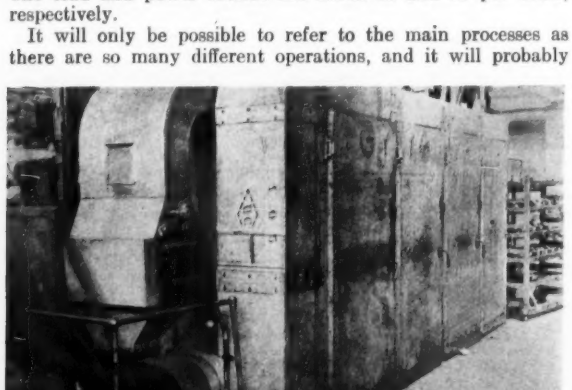
# Boot and Shoe Production

## The employment of group driving for many and varied processes

AN idea of the electrical applications in the manufacture of boots and shoes, and some power, consumption, and production figures which will serve for useful comparisons, were obtained during a recent visit to the largest (Arthur Street) of the three factories in Barwell, Leicestershire, of Messrs. George Ward (Barwell), Ltd. This factory is responsible for about 60 per cent. of the total production of the company, and is laid out broadly to deal with 2,400 dozen pairs of boots complete per week, in addition to producing some of the parts for the other factories.

The supply is metered jointly with that for the company's Kingfield works in which machining, top preparing, and clicking are carried out in about the same quantities as those at Arthur Street, described later. Well over 441,000 kWh was consumed during 1931. The total h.p. installed in the works visited is 260, representing 25 motors ranging from 5 to 20 h.p. The load and power factors are about 20 and 80 per cent., respectively.

It will only be possible to refer to the main processes as there are so many different operations, and it will probably



**Electrically heated sole-drying chambers**

help matters to deal with them in groups as they are in the various departments.

In the clicking room the various parts of the upper—vamps, caps, backs, &c.—are cut out on clicking presses—platen-type machines, with specially shaped knives. Twenty-two of these presses are driven by a 12½-h.p. motor.

The next operations, in the top-preparing section, are skiving, trimming the edges by revolving knives; perforating, punching patterns on the uppers; folding, turning in the edges; and capping, stitching the caps to the vamps. A 7½-h.p. motor drives 12 skivers, six perforators, four folders, six cappers, six side-lining machines, and a trade-mark stamper, all of which will deal with 2,400 dozen pairs of complete uppers per 48-hour week.

In the machine room there are closing machines which stitch the two portions of the back together, put on the back strap and stitch the linings to the backs; vamping machines which stitch the whole top in one piece; and button-holing and eyeletting machines. There are three drives in this department, two 7½ and one 5 h.p. One of the larger motors drives 60 machines, including post trimmers, button-holers, and stitchers, and the other serves 48 closing machines. From the 5-h.p. motor are driven two eyeletting machines, four lacers, one rapid hooker, and 12 other machines. Here again the department is designed for the production of 2,400 dozen pairs per week.

### "Team Work"

An interesting example of team work may be seen in the lasting room. Pulling-over machines bring the top to the shape of the last, over the inner sole, the operation being consolidated on separate equipment. Pounding machines level the bottoms of the uppers after lasting, so preparing them for the soles. A team consists of a pulling-over machine, two consolidators, one pounding machine, a sole attacher, and an assembling machine which fastens the back to the inner sole. There are eleven teams, and each will produce 250 dozen pairs per week. A 12½-h.p. drive serves three teams.

When shoes leave the lasting department they are often treated in drying-chambers, according to the atmospheric conditions, &c. In conjunction with these chambers there is a small motor-driven fan which circulates air over a 3-kW heating element and through a system of ducts into the chambers.

A total of 50 h.p. serves the riveting and stitching department, which is also laid out to deal with 2,400 dozen pairs per week. The sole is either riveted or stitched to the upper; levelling is an operation in which the whole shoe is shaped and made solid on special presses; finally, in this department, the heel is attached. A 12½-h.p. motor drives six sewers, six stitchers, four levellers, and two heel attachers, in addition to a number of channel closers, &c. The channel is the slit round the edge of the sole in which the stitches, &c., are concealed.

In the finishing section such trimming and like operations as heel paring and scouring, sole-edge and heel setting, and bottom scouring are carried out. There is a total of 80 h.p. of motors in this room, which includes the drives for the dust-extracting equipment.

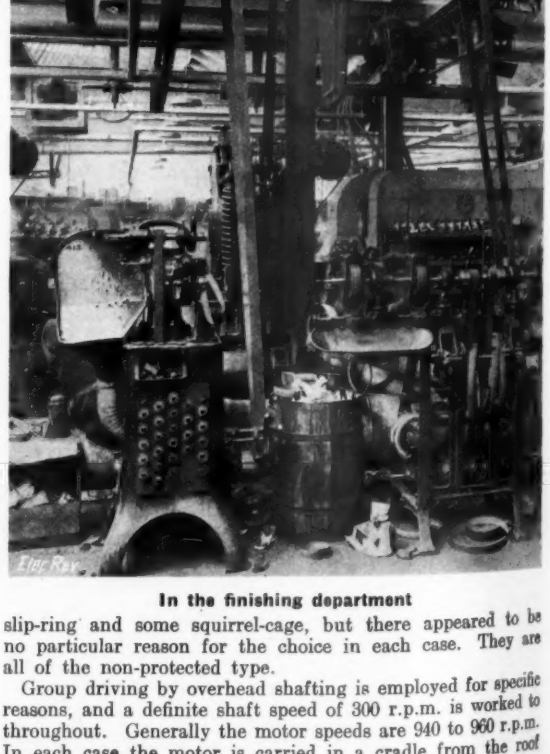
Sole and heel cutting and heel building are important operations carried out in a large separate department. Soles are cut on platen-type presses by specially shaped knives, and after grading, &c., they are dealt with on channelling and moulding (cutting to template) machines. All small pieces of leather are cut into various shapes on special presses for heel building. A total of 85 h.p. serves this department, and something like 3,500 dozen pairs of soles, inner soles, runners and middle soles, and also 4,500 dozen pairs of heels can be produced per 48 hours.

### Supply Arrangements

A supply is received from the Leicestershire and Warwickshire Electric Power Co. at 6,600 V, three-phase. A simple circuit breaker on site belonging to the supply company serves a 120-kVA transformer, *via* a condenser of the same size; both transformer and condenser were supplied by British Insulated Cables, Ltd.

Current at 440 V, three-phase, for power is distributed throughout the factory from B.T.-H. pedestal type oil circuit breakers, and at 250 V, phase to neutral, for lighting from M.E.M. ironclad distribution boards. Generally Callender's v.i.r. cables are used in screwed conduit.

Each motor is governed by a direct-on starter with overload and no-volt releases, either Ellison oil-break or B.T.-H. air-break. Oil-break switches are employed for motors above 12½ h.p., Crompton Parkinson, B.T.-H., Westinghouse, and Mather & Platt motors were seen in the installation, some



**In the finishing department**

slip-ring and some squirrel-cage, but there appeared to be no particular reason for the choice in each case. They are all of the non-protected type.

Group driving by overhead shafting is employed for specific reasons, and a definite shaft speed of 300 r.p.m. is worked to throughout. Generally the motor speeds are 940 to 960 r.p.m. In each case the motor is carried in a cradle from the roof girders, and the general arrangement, with the lattice-work belt guards, makes a particularly neat job.

# The Private Plant. By W. A. Tookey, M.Inst.C.E., M.I.Mech.E.

## The economics of Diesel-electric generation

IN the light of recent developments and experience with Diesel power plants over many years it is advisable to consider, when planning a new factory or rearranging an old one, whether the advantages of generating one's own electrical energy do not outweigh the convenience of buying power from outside sources.

Many commercial leaders say, "Let each man do his own job; mine consists in producing my own speciality. I don't want to be bothered with producing power when I can obtain it from outside sources, because there may then be consequent responsibilities involving special knowledge which I personally do not possess." This is a reasonable outlook, but, unless relative costs are gone into, a general assertion of this kind may have a serious effect upon production costs. Even when all goes well and there are no labour troubles or sudden interruptions to the supply from outside one's own works, the independently owned power plant has many advantages, and it is as well to apply the "yard stick" of £ s. d. values.

[*Vandyk*

**Mr. W. A. Tookey is a consultant whose name is very well known in connection with oil-engine installations**

It is proposed to base comparisons upon maximum demands of 50, 200, and 1,000 kW. It is assumed that the mean loads will amount to only two-thirds of the maximum over the whole period of working and as costs must be affected by the number of working shifts per day, the computations tabulated have been based upon 2,500 (one shift), 4,500 (two shifts), and 6,500 (three shifts) working hours per year.

### Costs of Operation

The calculations have been divided under two heads, (*a*) generating costs and (*b*) overhead charges. Of the generating costs the fuel consumption has been taken as 0.61 lb. of Diesel fuel oil per kWh—a figure quite easily obtainable under two-thirds load by any modern high-compression oil engine, whether with air injection or with mechanical injection. For less than 100 tons per year the fuel has been priced at 90s. per ton, up to 250 tons per year 80s., and beyond this amount at 70s. per ton. This is in general agreement with the present run of prices.

Experience has shown that one pint of lubricating oil per engine hour is an ordinary rate of consumption. Many engines are working with a smaller amount, according to the method of oil recovery adopted, but it is not my intention to base the estimates upon the best possible figures.

With regard to wages, the small installations would want the part time attendance of one man on each shift. Allowance has been made for the larger amount of attention that would be required when an engine is working round the clock than working shorter periods per day. In the larger stations two to three men are deemed to be employed—one wholly and others partly on each shift and, naturally, the cost of attendants' wages does not increase proportionally with the output, but with the number of engines and the number of shifts.

The allowance made for stores and sundries has been based upon experience and agrees closely with the figures applying to a number of plants already in existence and of the capacities mentioned. The amounts allotted under the heading of repairs visualise not only running repairs but the gradual deterioration of parts and their replacement at intervals conveniently determined throughout the engine's life. This charge varies with the number of shifts per day during which the engines are in operation.

### Capital and Overhead Charges

As it is the object of this article to assist those in charge of commercial enterprises to appreciate the costs of generating electricity by Diesel engines for three types of factories and three sizes of installation, it is not my intention to promise more than can be performed and no attempt has been made to cut down estimates of capital expenditure. For the 50-kW installation one engine only would be fitted; for the 200-kW installation, two engines; and for the 1,000 kW, three engines. In the latter case two of the three equal-sized units would operate for most of the time, the third acting as stand-by except during the periods of peak load.

Capital costs include erection, builders' work, and full accessories. For the smaller set the price is based at £30 per kW rating, the medium sets £27 and the largest sets £25; these figures are on the full side.

The yearly charges on the capital outlay have been computed at sinking fund rates to give 5 per cent. interest on amounts banked at the end of each year. The periods taken are for the one-shift plant, 25 years; for the two-shift, 20 years; and for three-shift, 15 years, because the longer daily period of working will shorten the working life of the plant. In many electric light stations Diesel engines are still at work after considerably more than the longest period given.

As an overhead charge, breakdown insurance has been allowed, for engines and for alternators, in accordance with the rates obtainable from one of the largest British companies; a similar amount has been included as a management charge to cover general supervision of the power house.

### Comparative Overall Costs

It will be seen from the table printed below that the costs per kWh generated vary with the size of installation and in accordance with the number of shifts worked, from 1.115d. to 1.14d. for the smallest installation, from 0.806d. to 0.69d. for the intermediate plant, and from 0.51d. to 0.448d. with the largest. The total annual saving through the employment of Diesel-engine plant ranges from £66 to £3,015, depending upon the size of installation and the number of operating hours.

In comparing these figures with the rates obtainable from supply undertakings for purchased current the maximum demand charge is taken at £4 10s., £3 15s., and £3 per kVA per annum, and the kWh charge at 0.5d. to 0.4d. and 0.3d.; thus the computations have been made on prices available in very few industrial areas.

With allowances for repairs, wages, sinking fund, insurance, &c., calculated on the low side, the total annual costs for current show that independent oil-engine driven electric plants promise annual savings that warrant close examination by all industrialists who wish to achieve low production costs.

DIESEL-ELECTRIC WORKING COSTS.

| Max. demand, kW. | 50 | | | 200 | | | 1,000 | | |
|---|---|---|---|---|---|---|---|---|---|
| No. of generating sets | One | | | Two of 100 kW | | | Three of 330 kW. | | |
| Shifts per day | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Operating hours, p.a. | 2,500 | 4,500 | 6,500 | 2,500 | 4,500 | 6,500 | 2,500 | 4,500 | 6,500 |
| | Thousands. | | | | | | Millions. | | |
| kWh. generated, p.a. | 83 | 150 | 216.5 | 333 | 600 | 866 | 1.66 | 3.0 | 4.33 |
| Fuel oil, tons p.a. | 22.5 | 40 | 60 | 90 | 163.5 | 236 | 450 | 820 | 1,180 |
| per ton sh. | 90 | 90 | 90 | 90 | 80 | 80 | 70 | 70 | 70 |
| £ p.a. | 101 | 180 | 270 | 405 | 655 | 945 | 1,575 | 2,870 | 4,130 |
| Wages, p.a. £ | 100 | 250 | 400 | 200 | 400 | 550 | 400 | 600 | 800 |
| Lub. oil, gal. p.a. | 300 | 550 | 800 | 600 | 1,100 | 1,600 | 900 | 1,650 | 2,400 |
| £ p.a. | 40 | 70 | 100 | 75 | 135 | 195 | 110 | 200 | 280 |
| Stores, etc., £ p.a. | 20 | 30 | 40 | 35 | 65 | 90 | 50 | 90 | 130 |
| Repairs, £ p.a. | 35 | 60 | 90 | 135 | 200 | 300 | 500 | 900 | 1,300 |
| *Total running costs*, £ | 296 | 590 | 900 | 850 | 1,455 | 2,080 | 2,635 | 4,660 | 6,540 |
| Total d. per kWh. generated | 0.855 | 0.944 | 1.00 | 0.612 | 0.581 | 0.576 | 0.38 | 0.373 | 0.362 |
| Capital outlay, £ | £1,500 | | | £5,400 | | | £25,000 | | |
| Sinking fund, years | 25 | 20 | 15 | 25 | 20 | 15 | 25 | 20 | 15 |
| " " at 5% interest, £ | 30 | 45 | 70 | 108 | 162 | 250 | 500 | 750 | 1,150 |
| Insurance, £ | 30 | 30 | 30 | 80 | 80 | 80 | 200 | 200 | 200 |
| General overheads, £ | 30 | 30 | 30 | 80 | 80 | 80 | 200 | 200 | 200 |
| *Total costs*, £ | 386 | 695 | 1,030 | 1,118 | 1,777 | 2,490 | 3,535 | 5,810 | 8,090 |
| Total d. kWh. | 1.115 | 1.11 | 1.14 | 0.806 | 0.71 | 0.69 | 0.51 | 0.465 | 0.448 |

ELECTRIC POWER COSTS.

| Max. demand, K.V.A. at 0.8 p.f. | 62.5 | | | 250 | | | 1,250 | | |
|---|---|---|---|---|---|---|---|---|---|
| K.V.A. charge, £ | 4.5 | | | 3.75 | | | 3.0 | | |
| " " p.a., £ | 281.25 | | | 937.5 | | | 3,750 | | |
| Meter rent | 5 | | | 10 | | | 25 | | |
| kWh. charge, d. | 0.5 | | | 0.4 | | | 0.3 | | |
| | Thousands. | | | | | | Millions. | | |
| kWh. p.a. (incl. 5% transformer and other losses) | 87.5 | 157.5 | 227.5 | 350 | 630 | 910 | 1.75 | 3.15 | 4.55 |
| kWh., £ p.a. | 182.5 | 328 | 473 | 583 | 1,050 | 1,515 | 2,190 | 3,940 | 5,700 |
| Attendance, repairs and running expenses, £ | 100 | 200 | 300 | 300 | 500 | 700 | 400 | 700 | 900 |
| Sinking fund, insurance and general overheads | 26.25 | 30.75 | 36.75 | 69.5 | 72.5 | 77.5 | 210 | 220 | 230 |
| *Total costs* | 595 | 845 | 1,096 | 1,900 | 2,570 | 3,230 | 6,550 | 8,610 | 10,580 |
| Total d. per kWh. | 1.72 | 1.35 | 1.215 | 1.37 | 1.03 | 0.895 | 0.947 | 0.69 | 0.585 |

# A Hosiery Factory

EXCLUDING the intricate inner workings of the stocking knitting machine, the machinery and general lay-out of the modern hosiery factory are simple and can be adapted particularly well to individual electric driving. These are our principal impressions as the result of a visit to the large hosiery factory of Messrs. Atkins Bros. (Hinckley), Ltd.

The bulk of the yarn is received in hanks and is machine wound on to bobbins ready for the hosiery knitting machines. About 30 h.p. of motors is installed for the winding operations. It is usual to fix a ½-h.p. motor for from 16 to 24 spindles, re-

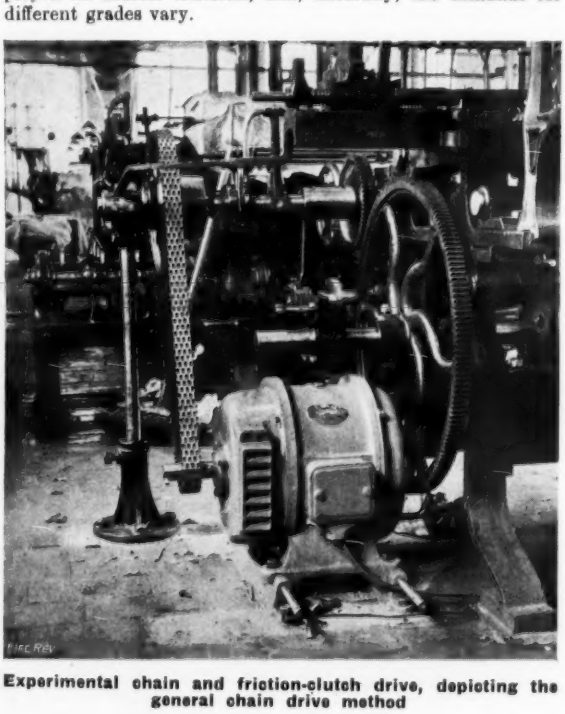
**Three-h.p. drive for twenty seamless knitting machines; ratio 6 to 1, 710-r.p.m. motor**

presenting one machine, or a 1-h.p. motor for a double-machine bank, the machines being arranged either back to back or in line.

## Knitting and Joining

Practically the whole stocking is made on the knitting machine, and such machines, in various sizes and types, according to the sizes and qualities of hose or half-hose to be produced, are generally arranged in banks of twenty, each bank being driven by a 3-h.p. motor. A set of ten knitting machines will produce from 100 to 200 dozen ladies' plain seamless stockings per weekly shift, according to the gauge of the machine.

The remaining essential operations are linking (joining the toe), seaming (joining the stocking up the leg), and welting (sewing the stocking). These operations are all carried out in one large "finishing" room, where group driving is employed from two motors—one 10 h.p. and the other 3 h.p.—the group driving being split because of different working conditions. The machines served by the smaller motor are employed on coarser material, and, naturally, the demands for different grades vary.



**Experimental chain and friction-clutch drive, depicting the general chain drive method**

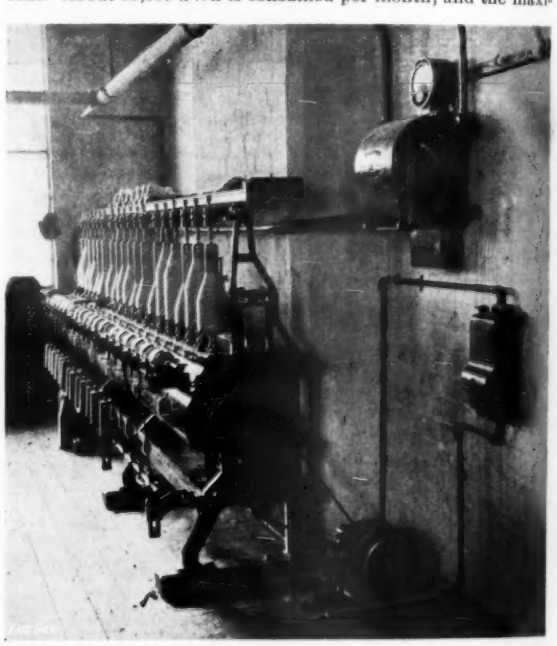
Group driving in these cases is justified because of the unfavourable machine diversity factor. The larger motor serves seventy linkers, twenty-four seamers, and ten welters, while from the smaller motor are driven forty machines in somewhat similar proportions. Generally, individual driving is employed throughout the factory, with Renold's inverted-tooth chains in conjunction with a counter-shaft and fast and loose pulleys in each case. The chains run through oil baths, and all the driving equipment, including the shafts and motors, run in ball bearings. The 10-h.p. drive in the finishing room has pump and sump lubrication.

In connection with a change-over from belt driving for some "Cotton's Patent" machines, producing fully fashioned stockings on the flat-knitting principle, chain driving with a special cone and chain friction clutch is being tried out experimentally in one case to avoid fast and loose pulleys, and also with a view to its adoption in a new factory of the company now nearing completion.

## Supply Terms

Supply is received at 6,600 V from the Leicestershire and Warwickshire Electric Power Co., and one transformer serves for both power and lighting—power 440 V, three-phase, and lighting 250 V, phase to neutral. As the standing supply charge is on a kVA basis, a 104-kVA condenser (Telegraph Condenser Co., Ltd.) is installed, which raises the average p.f. to about 0.92. With a change-over of the standing charge from kW to kVA, the installation of the condenser has resulted in a reduction in the overall kWh charge of about 0.2d. per kWh.

The installation load factor is in the neighbourhood of 20 per cent. About 30,000 kWh is consumed per month, and the maximum demand is approximately 170 kVA. There are seventy-seven motors in the factory, ranging from 20 h.p. down to ½ h.p., and representing a total installed capacity of 267 h.p. Something like fifty of the motors are of 3 h.p. each.



**Drive for twenty-four winding spindles; motor 0.5 h.p., 1,400 r.p.m., ratio 3 to 1**

Separate switches in the sub-station serve each block of buildings to which v.i.r. cable in screwed conduit is run to a four-way distribution box on the middle floor in each case. From these boxes an Ellison 60-A. air circuit breaker is fed, which governs the supply to a four-way distribution box, which in turn serves four three-way sub-distribution boxes, so that generally there are twelve motors on each floor.

The majority of the motors are controlled by direct-on starting switches, with fuses in line when the starter is in the running position. In practically all cases the starter is mounted on an iron frame immediately over the motor, so as to afford maximum access for the operator. All the motors, starters, etc., are fitted with screwed conduit connecting plates, and all those on boarded floors stand on metal plates—a fire-hazard precaution not always taken.

Most of the smaller motors were supplied by Veritys, Ltd., and the larger ones are of the Crypto type. The starters are mostly of Veritys manufacture, and the distribution boxes appear to be about evenly divided between Simplex and Veritys.

# The Importance of Metering. By V. Z. de Ferranti

## Checking the consumption of individual departments

FACTORY owners usually adopt electricity as a matter of course for lighting and for ordinary motive power, but they are often reluctant to embark upon any really extensive electrification of their production processes on account of uncertainty as to the running cost. A great deal of this uncertainty might be removed if all interested in electrical development would encourage detailed metering of all new industrial applications of electricity, and publish the valuable information thus obtained.

Many of us in the electrical industry may be prepared, in some instances, to do the thing electrically for the sake of good example, but there will be no general following of the example unless a sound case can be presented for it, based largely upon information which only metering can give.

At Hollinwood the aim is to use electricity for all purposes so far as is reasonably practicable, but it has often come as a surprise to find, particularly in certain heating applications, how complete has been the justification for electrical running, revealed by measurements made. Sometimes the surprise has been in the opposite sense, but the information obtained does indicate that the importance of such metering cannot be over-stressed.

### Departmental Costing

Many large industrial consumers are not even provided with the simple means of separately metering the supplies to individual departments; this should be regarded as necessary, in the interests of accurate costing. Where the tariff is based upon a maximum demand charge plus a kWh charge, each departmental circuit should have its own meter and maximum demand indicator, in order that its proportion of the electricity account may be correctly allocated. The sum

A typical departmental metering panel

of the indicated departmental maximum demands will generally be found to exceed the actual maximum demand, but the comparison of the figures for each of the several departments will enable the account to be allocated with reasonable accuracy, and will suggest an investigation if the demand of any particular department appears to be excessive in relation to its kWh consumption.

Demand meters of the printometer or other recording type will show at a glance the time at which the maximum demand occurs, but if the cost incurred is of doubtful justification, the same information can be obtained with a little more trouble by the use of a portable graphic recording wattmeter or ammeter transferred from circuit to circuit.

### Load Levelling

Such measurements will show that the individual departmental demand, like the total demand, usually reaches its maximum more or less regularly at a particular time in the day. If the time of an apparently excessive peak in any department coincides with that of the total maximum demand, it is likely to be due to the carrying on at that time of some non-continuous processes. Such processes can often be changed to some other time in the day without causing any dislocation in production, and substantial benefit derived by reducing the maximum demand and the electricity account.

The levelling of industrial loads on these lines presents attractive possibilities both to supply authority and consumer, by improving the load factor of supply and reducing the cost of energy. In premises where use is made of thermal storage, and possibly some other applications of electricity in which the supply may be temporarily disconnected without inconvenience, it may prove desirable to effect this levelling automatically by means of relay devices arranged to control the "dispensable load" in steps according to the rise and fall of the total load on the circuit. This system of load levelling has already been very successfully applied to the control of a large domestic installation. In the case of a tariff incorporating a specially low night rate, the consumer should explore every possibility for the economic transfer of load from the normal working hours of the day to the hours of low rate; careful metering is essential to the full realisation of this advantage. So far has it been possible to proceed in this direction at Hollinwood that, under present conditions, the energy consumed during the night is very nearly equal to the daytime consumption.

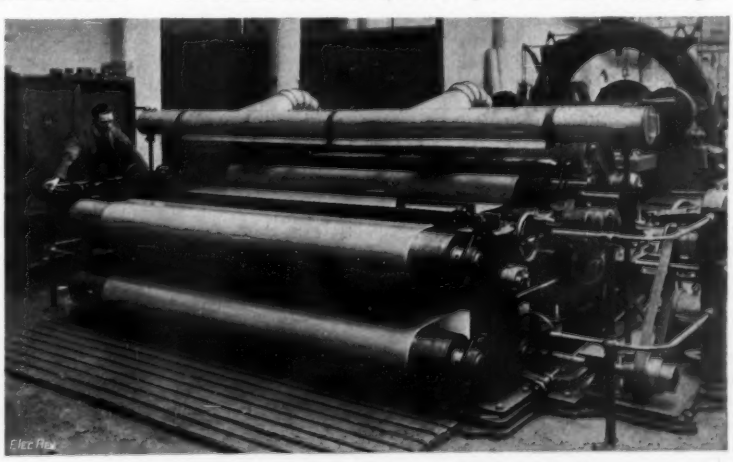
Mr. Vincent Z. de Ferranti, chairman of Ferranti, Ltd.

A tariff now under consideration withdraws some of the inducements to increase the night load, but the evidence afforded by further metering has shown that, under the existing tariff, a saving would be effected by transferring to night running the whole plant engaged upon a process representing a steady load of the order of 400 kW, even though female labour would have to be replaced by the more expensive male labour paid at overtime rates.

### Ascertaining Power Factor

Where the tariff provides for something in the nature of a penalty or bonus, according to the power factor of the load, the consumer should be encouraged to provide himself with means of ascertaining the power factor of his separate circuits. He may otherwise bear the burden of extra cost due to a low power factor without knowing which items of his plant are responsible for it. A portable power-factor meter, introduced from time to time into his various circuits in turn, may provide indications of big economies to be effected by the installation of equipment for power-factor correction.

Recent tendencies have been towards the elimination of meters and instruments, save only for the most essential pur-



Paper-tube making plant with electrically heated rollers

poses, requiring the consumer to accept his supply without expecting to know a great deal about it. Even the consumer's switchboard, once an array of measuring instruments, rarely carries now any meters other than those of the main supply. It has been done in the interests of cheaper electricity, but it has been carried too far. The consumer cannot know too much about the details of his consumption, and the information which is to be obtained by intelligent metering will help the consumer and his supplier and thus assist the cause of further electrical development. It is recommended therefore :—

(1) That kWh meters should be installed in individual circuits.

(2) That maximum demand indicators should be installed in the individual circuits of consumers charged on a maximum demand basis.

(3) (*a*) That means should be adopted of ascertaining the time of peak demand in each circuit, either by the use of recording m.d.i. meters or the occasional use of portable graphic recording wattmeters or ammeters; (*b*) that the information thus obtained should be made the basis for a levelling of the consumer's load.

(4) That consumers charged according to any tariff which incorporates a power-factor clause should be encouraged to know the power factor of each individual circuit in their installations.

# Biscuit and Cake Making

ECONOMY, cleanliness and ease of control are all attributed largely to electric driving and baking at the modern cake and biscuit factory of Messrs. Alfred Hughes & Sons, Ltd., at Adderley Park, Birmingham. The average monthly output of biscuits and cake are 150 and 50 tons, respectively, and the average electrical consumption for the same period is 40,000 kWh. The total capacity of motors installed is 350 h.p. in various sizes, practically all of B.T.-H. manufacture, and there are six 32-kVA Baker Perkins electric cake ovens.

Sugar grinding is one of the initial processes in the cake-making section, and one machine, delivering three grades, recently dealt with one ton of sugar in five hours. It is driven by an 11-h.p. motor. Ingredient mixing is, of course, of prime importance, and the largest of a bank of machines seen will deal with 450 lb. of fruit cake in 20 min.; it is driven by a 6.5-h.p. motor. An electrically driven egg mixer will deal with 4 gal. of eggs and 40 lb. of sugar.

## Electric Cake Ovens

Each of the six ovens referred to, which are arranged in three two-tier banks, holds 72 seven-lb. cakes, or their equivalent, and the baking time is two to three hours, according to the quality of the cakes. One of the great advantages of the electric cake oven stressed by our guide was the ease of obtaining the essentially different top and bottom oven temperatures. The temperatures are automatically controlled by relay and contactor gear mounted on top of each unit in conjunction with Cambridge thermometers. There are six ribbon elements at both the top and bottom of each oven, each element being 12 ft. long and 1 ft. wide.

The elements are star connected, supplied at 440 V, and the total loading for each oven is 32 kVA. A 17-kVA, single-deck G.E.C. oven with top and bottom spiral elements was also seen. Fruit-cleaning machines should also be mentioned as part of the important cake-making equipment.

Flour for biscuit making is elevated to a travelling hopper equipped with an automatic electric weigher. The fall of the weighing lever breaks the circuit of the no-volt coil on the elevator-motor starter. The travelling hopper serves a line of biscuit-mixing machines, four of which, served by a 35-h.p. motor, will deal with 22 cwt. of mixture in an hour.

The emptying of the mixture is controlled electrically, and the next essential operation is what appears to correspond to kneading and is carried out on the biscuit brake. This is served by a 10-h.p. motor, and it will deal with 9 cwt. of dough in an hour.

## Biscuit Cutting and Cooking

The next operations of rolling the dough to the required thickness and cutting out the shapes of biscuits are in charge of a multi-purpose machine driven by an 8-h.p. motor, which also drives a revolving brush for cleaning the dough surface, and a conveyor. The shaped portions fall on to trays for conveyance into the oven, while the surplus is separated and taken back to the kneader.

A biscuit brake, a rolling and cutting machine and a travelling oven, are all operated, in effect, as one unit, the outputs of the subsequent sections corresponding to that of the first portion, the brake. The average time for baking the biscuits is eight minutes, and the oven conveyor is driven by an electric motor.

**A biscuit dough brake (foreground), dough roller and cutter, feed end of a biscuit conveyor oven**

The electrical mind, of course, regards the existence of the gas-heated biscuit ovens as unfortunate, and the explanation given was that the "gas people got here first," but it was encouraging to learn that the company has its eye open for the appearance of a satisfactory electric oven for the same purpose. On top of each biscuit oven is a 2-h.p. motor driving a compressor for forcing the gas through the oven jets.

Except when they are to be iced, the biscuits are packed after cooling, direct from the conveyor at the other end. A special machine for icing, driven by a 0.4-h.p. motor, will deal with 8,000 biscuits per hour. Three girls operate this machine with the same output in 2½ days as 32 girls can produce by hand in one week. The machine is fitted with emergency stops at various positions, and also an electrically heated cream container (1,200 W).

The above are the major operations of the factory, but the electric drive was seen in use in many other connections. A wafer-biscuit conveyor oven, for instance, will produce 600 lb. of wafer per day, and a 3-h.p. motor serves the conveyor, a pump for transmitting the liquid material for pressing between heated plates on the conveyor, and a compressor for the gas supply. A machine which wraps and bands 3,000 chocolate biscuits per hour and a chocolate enrober are among the other electrically driven "auxiliaries."

# The Cabling of Factories. By H. Marryat, M.I.E.E., M.I.Mech.E.

## The need to plan the electrical layout in advance of building construction

IN laying out the electrical installation of a new factory the electrical engineer should be in active co-operation with the architect before the building plans are settled. Ample provision for conduit runs should be shown on the builders' drawings, together with horizontal and vertical ducts for mains and arrangements for a suitable intake chamber in the right position. Separate provision should be made for telephone, bell, and other services in the earliest stages of the job.

Mr. H. Marryat, a past-president of the E.C.A., is one of our best-known electrical installation engineers

Only in this way can expense, delay and destruction, caused by chopping a building about after it is constructed, be avoided; incidentally a more satisfactory installation will be secured. At the largest concrete factory building in London, a box for every lighting point was cast in the concrete whilst building; this perfection is not always attainable.

In modern factory construction, the largest possible spaces are enclosed without partitions or other roof support. As electric motors and other energy consuming devices will be installed anywhere within these spaces, the cables must rise from the floor or descend from the ceiling. Each method has its own difficulties, which may be largely overcome by careful provision in advance.

### Overhead or Underground Cabling?

With a north-light roof the worst place to fix overhead conduits is on the roof itself, where variation of temperature and consequent condensation are at a maximum. It is better to fix suitable supports at the level of the tie bars. The problem of dropping the cables from this point is the same as for any other floor of the building.

Ordinary heavy-gauge electric conduit is not strong enough to withstand the wear and tear of factory life. An alternative is to use heavy-gauge wrought-iron tubes, fixed to special supports or to the ceiling and the floor by means of large flanges, with a tee and flexible metallic tube connection at the level of the motor terminals to allow for adjusting the motor position upon its slide rails. Possibly a better course is to provide flexible metallic conduit from a junction box on the ceiling level to the motor terminals. Here there is no pretence of rigidity and damage does not so readily occur. Such a flexible conduit should, however, be attached to any intermediate support which may be available.

But a far preferable method is to cable from below. If the concrete floor is covered with a wooden one, no difficulty arises, as the conduit may be run on the surface of the concrete and beneath the wood. If, as more usually happens, the concrete is simply covered with asphalte or a hard finishing surface the conduits must be cast in during the building, or the floor will be seriously damaged by cutting and making good afterwards. It is, in every way, best for the conduits to be cast in, properly drained and ventilated, and that is why it is important for the electrical engineer to be consulted before the building is put in hand.

### Arrangements in Advance

A natural objection to this method is the difficulty in saying in advance exactly where each motor will be fixed, but the conduit may be run to a bronze flush floor box placed underneath the machine to be driven and clear of gangways. From here, when the motor is fixed, a steel tube may be run over the surface without causing inconvenience or obstruction. At worst, if the plant be so arranged that some of these boxes are left in the gangways, then the amount of floor channelling is comparatively slight and unharmful.

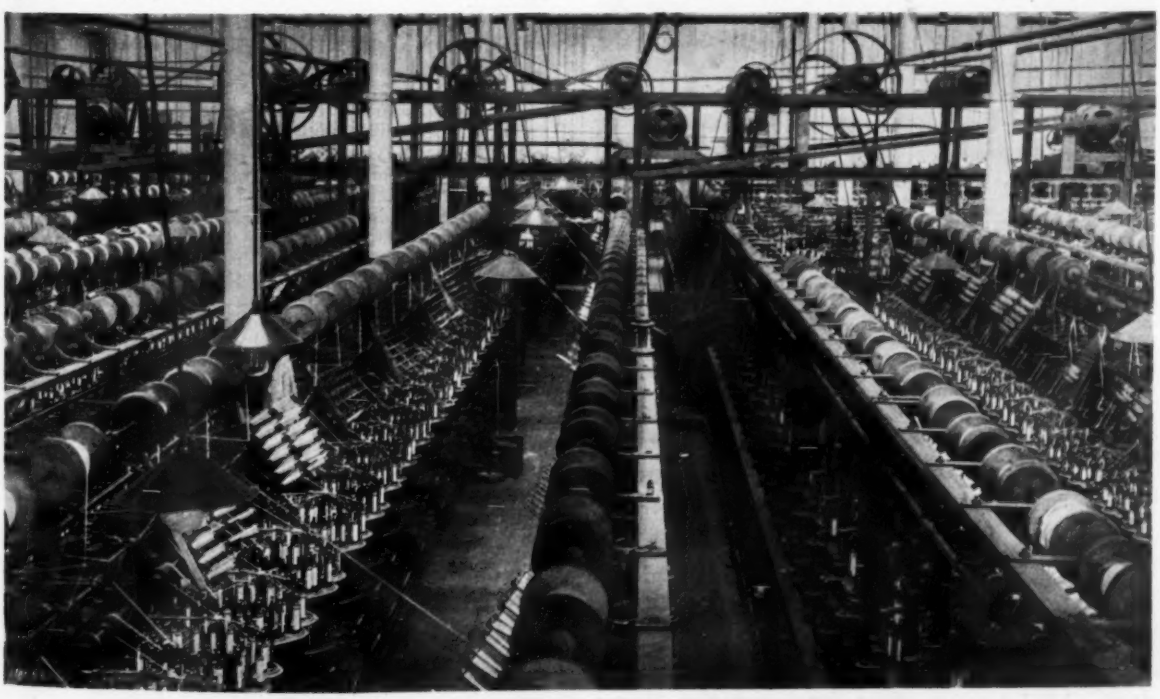
Starting panels should be placed, for safety, as near as possible to the motors they control. Installation cost is also greatly reduced by this means, because many more cables have to be run between the starting and control panel and the motor than need go back to the distribution board. The cost of fixing and wiring for emergency stop buttons is not heavy, and these should be provided at all dangerous points about any motor-driven machine.

Care should be taken in the building drawings to provide ducts large enough to take all main conduits, with ample provision for extension. The surface of floors should be not less than 2 in. above the tops of steel beams, to provide for the possible future necessity of burying tubes up to 1¼ in. diameter in the floor.

If the service is to be taken from an overhead supply, the transformer plant or sub-station and the main switches, fuses, and circuit breakers should be fixed in a properly designed house on the roof, or on the top of a staircase tower. If the service is from underground, this equipment may be located in a suitable chamber in the basement or on the ground floor.

If the electricity supply is alternating, the authority may insist upon power factor correction, and in any case, this should always be borne in mind, as the improvement of power factor may effect substantial reduction in the electricity account.

In considering this proposal, depreciation and capital charges on the plant involved should be set against the estimated saving on the electricity accounts, and will usually be found in



Elastic web and braid production: a view of a Nottinghamshire factory

favour of the installation of condensers or other power factor correction plant.

From the main intake to the points where energy is utilised, the guiding principle of layout should be simplicity and flexibility. It should be possible to trace any cable in a few minutes without possibility of error, and there should be no difficulty in extending the installation indefinitely without change of system or the undoing of any material part of the work already done. By means of adequate circuit breaking devices a serious breakdown in any one part of the installation should have little or no effect upon the rest.

### Motor Connections

At the point of intake, a distributing board may be fixed from which, in the case of a small building with few motors, cables may be run to each separate machine. If there are more than, say, half a dozen motors, mains may be run from this point to centres of distribution situated as nearly as possible in the centres of the departments where energy is consumed. These mains, if long or heavy, may be of lead covered and armoured cable fixed, without further protection, on the surfaces of walls or in ducts left in the concrete construction.

It is wise to provide overload release circuit breakers (which have many advantages over fuses) upon the main distribution board to protect these cables and the sub-distribution system. The sub-distribution boards again may, with advantage, be equipped with smaller circuit breaker protection for each individual motor, but the economy of this refinement must be considered in connection with the particular circumstances of each installation. From the sub-distribution boards cables may be run direct to the motor positions in screwed steel conduits as explained above.

The lighting of the building will originate at the intake point and will not be in any way connected with the power distribution, but the cables from the main lighting board to sub-distribution boards may often conveniently be run in the ducts used for the power cables and other services.

### Comparison of Systems

I have had in mind throughout, an installation comprising v.i.r. cables in heavy-gauge screwed-steel tube, because this will give a permanently satisfactory service under normal conditions for the twenty or thirty years' life that can be expected of a modern factory without reconstruction. There are other and less expensive systems, such as tough rubber sheathed cables run without further protection, except in exposed places, and lead-covered cables similarly installed. The broad line of distribution remains the same, but the effect taken over a number of years is not, in my opinion, so satisfactory.

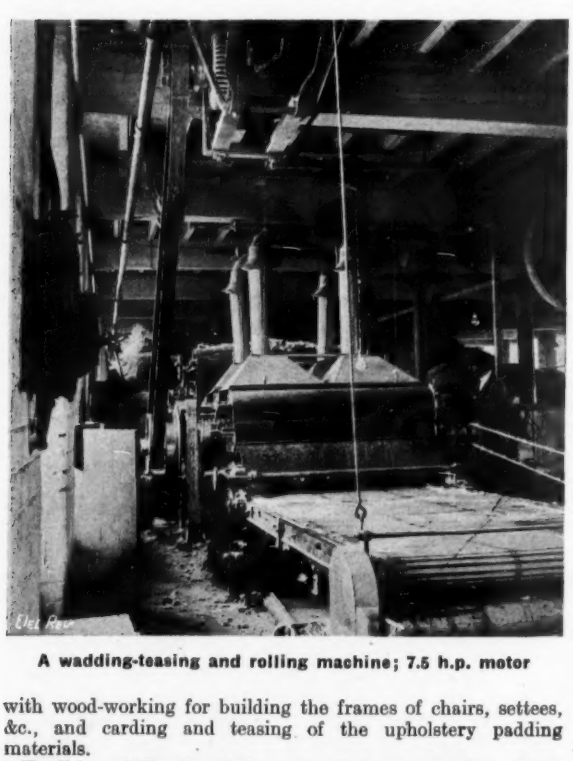
But each of these systems has its own very particular advantage in special cases. For instance, in the presence of much condensation steel tubes quickly perish, while tough rubber cable supported upon insulators, will withstand the conditions for a great many years. The wires sag after a short time and offer a poor appearance, but they do not fail. In the presence of acid fumes, corrosive chemicals, extra high temperatures and other abnormal conditions, expert opinion must be taken before deciding upon a system of cable insulation and protection.

Whatever material may be selected as the most suitable, strict observance of the Regulations for the Electrical Equipment of Buildings, issued by the Institution of Electrical Engineers, should be insisted upon. No lower standard may be considered safe and no higher standard is necessary in view of the rapid obsolescence of factory equipment which is now a feature of the times.

# Electricity in Chair Making

INSUFFICIENT attention is given to the comparatively small industrial electricity consumer, although collectively he is probably of major importance, both commercially and technically. Generally he represents the more common place and popular productions, and his numbers render it difficult to make a selection.

A typical example of this class is the Buoyant Upholstery Co., Ltd., in whose works at Sandiacre, Notts, about 100 h.p. of motors is installed in comparatively small units. The major operations from the electrical point of view are in connection with wood-working for building the frames of chairs, settees, &c., and carding and teasing of the upholstery padding materials.



**A wadding-teasing and rolling machine; 7.5 h.p. motor**

English and Empire timber, after being seasoned or dried, is cut into sizes approaching the finished requirements, planed, sawn, bored and generally finished ready for framing up in an electrically driven wood mill where there are two main group drives. A 35-h.p. motor serves a four-cutter planing machine, a panel-planing and thicknessing machine, two circular saws, one surface planer, a spindle moulder, twin cross-cut saw, and a boring machine, in addition to trimming equipment in the frame shop above, including a band saw, a disc sander, and two circular saws.

Two band saws, a surface planer, three triple-spindle and one single-spindle boring machines, two wood-turning lathes, a belt sander and a double-action six-spindle borer are all driven by a 25-h.p. motor. There are also a few "built-in" individual-drive machines, a notable example being a 5-h.p. Wadkin cross-cutting and trenching machine.

All these machines are engaged on the production of the finished parts for frames of chairs and settees, as well as parts for bus seats and beds, and feet for chairs and settees. In the frame shop above, which houses the trimming equipment referred to, the various parts are clamped together by dowels and glue, and braced at the corners, prior to trimming and finishing.

### Producing the Padding

A wadding machine represents a valuable electrical load, in that it runs continuously for six days and nights every week. It is driven by a 7½-h.p. motor. Cotton is teased into the required weights and thicknesses for the upholstery departments, and carefully laid out continuously in snow-like carpets, upon the machine, and rolled up, in a continuous sequence of operations. This machine will produce about a ton of treated wadding per week.

A carding machine is used to break up the harder materials, and also to mix jute and cotton. An assistant in this department told us that a record production for this machine was twenty-three 56-lb. bags in 1¾ hours. It has a 4-h.p. motor.

In the springing department the frames are classified, and bars and certain of the springs made by the Lace Web Spring Co., Ltd., are fixed to the frames before the latter are passed to the upholstery sections where sewing electrically is a major operation. Chair covers, &c., are sewn as far as possible on a group of 19 "Singer" machines served by a 3-h.p. motor.

There are also four sewing machines with individual ½-h.p. drives employed in making loose cushion covers—two working on fabric and two on leather. An interesting point is that these are all identical machines, except that the two engaged on leather have special feet to hold the material.

Covered springs from the Lace Web Co. in cushion form are upholstered with canvas, horse-hair, wadding, and calico, and in the same department feather cushions are also handled. In the finishing departments such operations as cording, slip stitching, and the fixing of feet, castors, linen bottoms, &c., may be seen carried out.

Many of the processes referred to are carried out by hand, but one of the purposes of such articles as this is to suggest opportunities for further applications for electricity.

# Lighting in the Factory. By W. J. Jones, M.Sc.

## The economy of adequate illumination properly placed

DURING the prevailing industrial depression factory executives are making every endeavour to reduce costs and at the same time maintain or even increase production. Small items of cost are scrutinised in every detail and cut down to the bare minimum; lighting is frequently one of the subjects so treated, but money spent on good lighting is an investment that pays very handsome dividends. Perhaps the best way to present the case for better lighting is to treat it purely from a financial point of view, and a comparison is drawn below of the costs of a hypothetical machine shop lighted under an "average" system and under the modern system.

Let us assume that the machine shop is 80 ft. long and 40 ft. broad, containing 24 lathes used for medium rough work. Under the old system a 60-W lamp would probably be employed in an enamelled pendant arranged to hang over or near each machine; to light up passages round the walls, 12 more might be used.

The capital cost of such an installation is :—Thirty-six 60-W lamps, £3 3s., thirty-six shades £6 15s., wiring, etc., thirty-six points at 15s. per point, £27, total £36 18s.

The running charges will be as follows :—Interest on capital (5 per cent.) £1 17s., lamp renewals, breakage, pilfering, etc. £2, energy for 300 hours at 1d. per kWh £2 14s., total £6 11s.

For a modern installation, with thirty-two industrial dispersive reflectors spaced 10 ft. by 10 ft., using 200-W lamps, the capital costs will be :—Thirty-two lamps £12, thirty-two reflectors £31, wiring, etc., thirty-two points (at 15s. each) £24, total £67.

The running charges will be :—Interest on capital (5 per cent.) £3 7s., lamp renewals £4, energy for 300 hours at 1d. per kWh £8, total £15 7s.

The difference in annual cost between a good and bad installation is thus less than £9.

### Increased Production

In this shop there will be at least 24 men working at an average wage rate of, say, £3 10s. per week, making an annual wages bill of £4,368. Overheads bring this up to, say, £6,000, and to earn a fair profit this shop must therefore produce goods worth £6,600 per annum. The £9 paid for better lighting is only 0.14 per cent. of the value of the work produced, so if it causes production to be speeded up by only 0.14 per cent., the increased illumination pays for itself. Investigations show that it is reasonable to expect an increase in value of production of at least 5 per cent., in which case the better lighting pays for itself more than thirty times over.

Several factors contribute to increased production and better quality of work. Under increased illumination work revolving in a lathe *appears* to be moving more slowly than it does under a low standard; although the machines themselves cannot perhaps be speeded up, the increased speed of vision and visual acuity reduce considerably the risk of spoilage. The Ford Motor Works at Dagenham, for instance, uses an illumination of no less than 20 ft.-candles, and waste and spoilage are probably reduced more than in any other similar works in this country. In the examples given, the illumination would be about 3½-4 ft.-candles under the old scheme, and about 10 ft.-candles under the new, these figures depending on the colour of the walls and ceiling.

The foreman can see the whole shop and everyone in it, and minor breaches of discipline, such as the pilfering of lamps, etc., will not pass unnoticed. The glare of lamps in unsuitable shades, prevents his seeing what is going on in the more remote parts of the shop. Glare is practically non-existent with the industrial reflectors, and the absentee rate will fall due to the avoidance of headaches, eyestrain, and allied nervous ills.

The direct loss due to accidents is enormous, and the indirect loss multiplies it many times. By indirect loss is meant loss of time of employés due to curiosity or rendering assistance to the injured, cost of medical assistance, breakage of tools or machines, cancellation of contract due to non-completion in time, and, particularly in highly organised works, the interruption of productivity.

The old type of installation referred to is probably a fair average of those in the country, and well above the average of small works. There *seems* to be plenty of light, but the manager is apt to forget that he does not merely pay for lamps,

**The evenly distributed illumination of an engineering works**

but for *light where it is required*, which is not in the eyes of the worker. Any attempt to increase the illumination of the shop merely by substituting 100-W for 60-W lamps will end in failure, owing to the increased glare.

### Basis of Installation Layout

A modern lighting installation *must* be planned in relation to the class of work to be done and the machinery to be installed. Great care must be taken in the spacing and height of the units, to avoid dense shadows being thrown by overhead shafting and belting. In some cases it might be advisable to mount larger lamps in concentrating reflectors higher up, or again, particularly in places where reflected glare from polished surfaces is likely to be encountered, some sort of diffusing fitting should be used. In every case, however, it is worse than useless to space the units haphazardly, as this results in uneven intensity and eyestrain due to the contrast of light and dark patches.

If particularly fine work is being done, it is best to provide a good general level of illumination—say, 8 to 10 ft.-candles—and to light up the tool point by means of one of the local lighting fittings available. These are provided with a jointed arm that can be fixed in any position, and a small, deep reflector that effectually conceals the 40-W or 60-W lamp from the operator's eye. General lighting should not be reduced where local lighting is employed, as, if the contrast between the illumination of the tool point and of the rest of the shop is too great, some time elapses before the operator's eyes become accustomed to the gloom of the shop, and it is during this period of adaptation that accidents are likely to occur.

Bad lighting costs money, good lighting makes money.

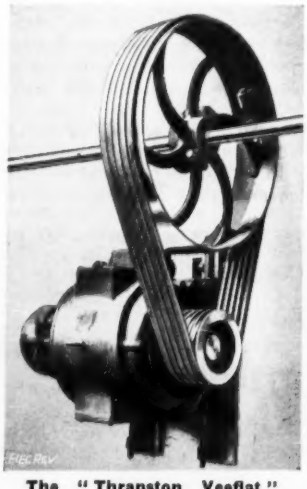
# Bringing Power to the Tool. By W. E. Swale

## A brief survey of modern tendencies

MUCH ingenuity has been expended in recent years in developing specialised forms of motors, the object of which, broadly speaking, is to develop power nearer and nearer to the tool itself. The average, straightforward, three-phase induction motor, the simplest and cheapest power unit known, does not, at first sight, appear to be capable of much improvement; yet the tendencies towards higher efficiency, less weight, and smaller dimensions, are clearly shown in the following table, which relates to a standard 100-h.p. 750-r.p.m. slip-ring motor, with pulley and slide-rails.

| Date of manufacture | 1910 | 1931 |
|---|---|---|
| Full load efficiency (per cent.) | 89 | 91 |
| Overall space required (cu. ft.) | 85 | 52 |
| Weight per h.p. (lb.) | 30 | 19 |
| Price per h.p. | £1 5 0 | £1 6 0 |

### Short Drives



The "Thrapston Veeflat" drive

The ordinary long centre belt or rope drive still has many uses, but the ever-growing appreciation of unit drives has favoured the development of special devices for short driving centres. The "Renold" bush roller chain is not a novelty, but an efficiency of between 98.4 and 98.9 per cent. (recently certified by the N.P.L. for a 25-h.p. 3-ft. centre drive) is worth noting. Where a cheap, silent, and relatively efficient short centre drive is needed—and considerable floor space can be saved by its use—many varieties are now available. Examples are the "Texrope," and similar cotton-rubber belts working in "V"-shaped pulleys. A recent variation is the "Thrapston" drive, where for ratios of 3 to 1 or more, an ordinary flat-faced pulley is used for the driven unit. Centres as short as the diameter of the driven pulley are satisfactory. For similar purposes an endless cotton rope of "V" section is also being manufactured.

### Gear and Motor Design

For ratios beyond the range of belt drives, the worm-gear finds increasing application by virtue of its silence, compactness, and low maintenance costs, and this mechanism, again, has been remarkably improved in recent years. A 40-h.p. drive, reducing from 600 to 60 r.p.m., showed a test-bed efficiency of 93.4 per cent., and this figure is likely to improve when the gear is well run in. An interesting design, which finds ready application for very slow-speed drives (used for erecting-belts, conveyor-type heat-treatment furnaces, &c.), is a combined worm and epicyclic spur gear, made for ratios as high as 3,000 to 1. Certain types of worm-gear are equally suitable for speed-increasing, and are applied successfully to grinding machines, high-speed pumps, &c.

The mechanical design of motors has undergone marked changes. Ball and roller bearings, after being looked upon with suspicion for several years, are now universally accepted; welded frames have reduced weights and costs materially. The spread of a.c. distribution has naturally favoured the induction motor, so that first costs of motor equipment, maintenance costs, and operating troubles are uniformly decreasing. The juxtaposition of motor and machine has emphasised the need for dust- and shaving-proof enclosures. The totally enclosed frame, having thrown out various strange sports in the form of pipe-ventilated and radiator-cooled constructions, has recently reverted to type as the totally enclosed frame-cooled motor, a design which offers many advantages, and is likely to enjoy some degree of permanence.

### Ultra-synchronous Speeds

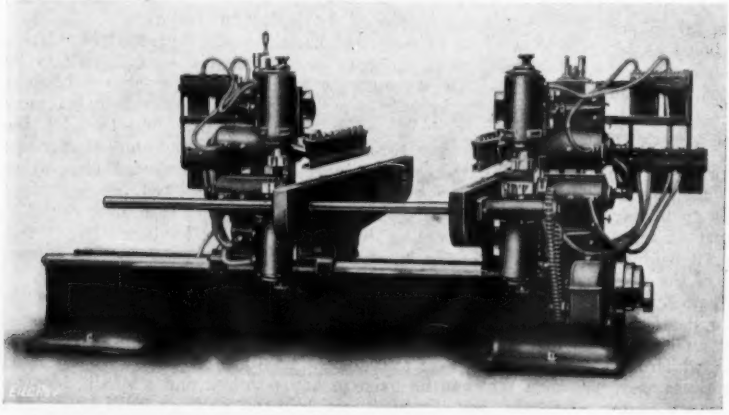
British motor manufacturers have made rapid advances in the design of a.c. variable-speed motors, and it can be said that the great majority of everyday problems of speed control can now be met simply and economically by various types of a.c. motors. Furthermore, and this is an instructive side-light on the unexpected nature of certain lines of development,

A 600-h.p. synchronous induction motor, driving four rubber mixing mills through magnetic safety coupling and correcting works power factor

a range of ultra-synchronous speeds is available which is far beyond the limits attainable by any kind of d.c. motor.

| | Shunt-wound d.c. motor with starter. | High power factor a.c. motor with starter. |
|---|---|---|
| Horse-power | 50 | 50 |
| Speed (r.p.m.) | 720 | 735 |
| Full-load efficiency (per cent.) | 90.7 | 90 |
| Full-load power factor (per cent.) | — | 100 |
| Price | £117 | £146 10s. |
| Annual running cost, at 1d. per kWh., allowing 1,250 kWh. per kW. connected. (With a.c. supply a bonus of 6¼% is assumed.) | £214 | £201 |

The makers of modern wood-working machinery, more progressive in some ways than the machine-tool makers, have rapidly developed the individual drive to its logical conclusion, and in many new machines they mount the cutting tool direct on to an extension of the rotor shaft. Rotor "units," consisting essentially of cast aluminium squirrel cages, and wound stator units, having smooth cylindrical exteriors, are built into the machinery, thus eliminating transmission losses, conserving space, and making possible a modern tool of unequalled efficiency. By using the standard mains frequency, or a combination of ratios in special frequency-changers, a set of speeds between 3,000 and 18,000 r.p.m. is available.



An all-electric double-ended wood-tenoning machine with eight built-in, separately controlled motors (B.T.-H.)

Low power factor can be alleviated at the source by many designs of high-power-factor commutator motors. A motor of this type often allows a certain speed variation, which is useful when, in converting, for example, a direct-coupled fan drive, it is essential to retain a speed intermediate between the usual asynchronous speed of the plain induction motor. The economy of such motors, in cases where a power factor bonus is offered, can be gathered from the table above. It is seen that, although the first cost of the a.c. commutator motor is higher, the difference is saved in a little over two years.

The schemes for the standardisation of frequency, and change-over from d.c. to a.c., are giving factory owners a unique opportunity of modernising their power equipment.

# A.C. Motors. By L. E. Wood, A.M.I.E.E.

## The importance of control gear

MOST supply undertakings impose regulations restricting the use of the squirrel-cage machine. In some instances the limit is 7½ h.p., above which it is compulsory to install slip-ring motors. The introduction of a wound rotor and brushgear does certainly involve higher first cost and increased maintenance charges, but modern slip-ring machines differ greatly from their predecessors of only a few years ago; they are lower in price and show marked advance in the design and construction of such components as rotor windings, slip rings, brushgear, bearings, and in the heavier shafts used. So reliable has brushgear become that brush lifting and short-circuiting gear is not required.

Although the tendency is towards the individual drive, a relatively large synchronous motor may often be employed for correcting a low power factor, as well as for carrying load.

**Mr. L. E. Wood is managing director of the Airedale Electrical and Manufacturing Co., Ltd.**

### Types of Motors

As a general rule these machines are of the salient pole type with the addition of a squirrel-cage winding in the pole faces, so designed that the machine will start up as an ordinary induction motor; when full speed has been reached, the field winding is excited and the motor pulls into synchronism. At full load there is a point of excitation at which the current drawn from the supply mains will be in phase with the voltage. If the exciting current is increased, the motor will supply a wattless-component current to the line, and thus improve the power factor of the system. In build, this type of machine is of the soundest, and the air gap may be so large that there is no likelihood of the stator and rotor rubbing. Its efficiency is higher than that of the ordinary induction motor, especially if operating at unity power factor. It is also possible to proportion the design so that the efficiency is practically constant from one-third of full load to 10 per cent. overload. For low speeds the synchronous motor is considerably cheaper than the induction motor for outputs above 150 h.p. Where constant speed is important the synchronous motor is ideal, as its speed is governed by the supply frequency.

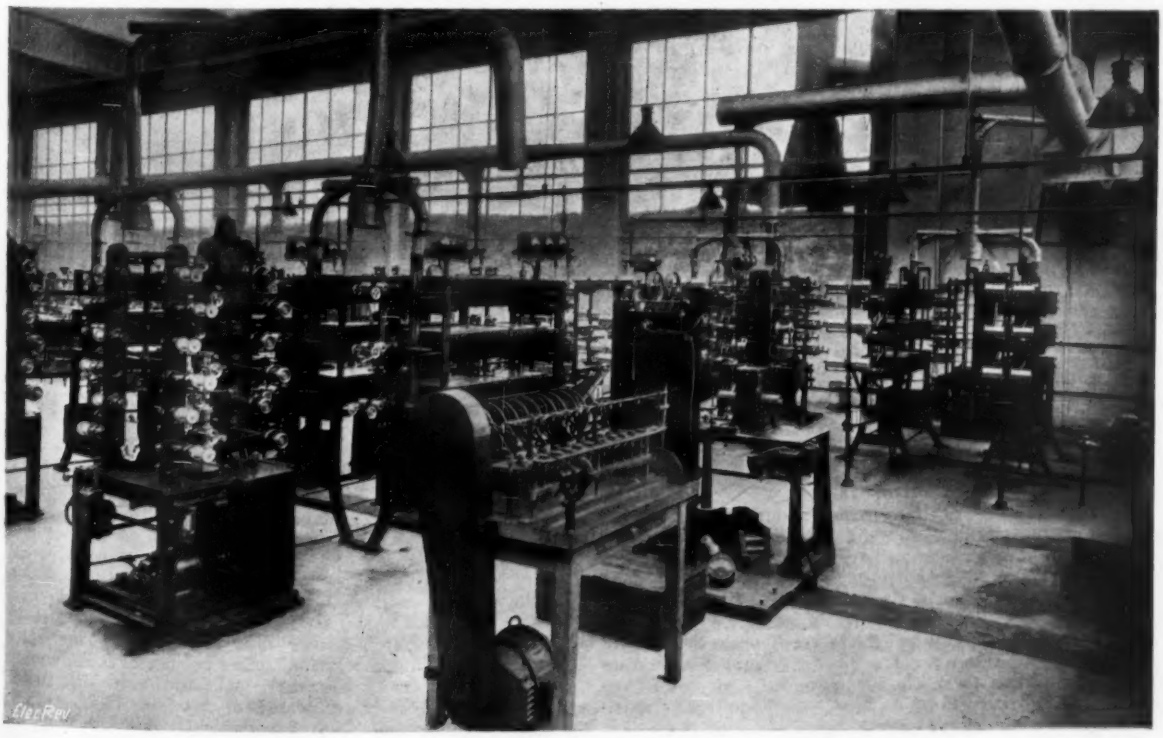
Shafting is rapidly being superseded by the individual drive, even where group driving was once considered essential. The individual driving of mule spinning frames presents no difficulties, either mechanical or electrical, and, as such machines demand unvarying speed, the auto-synchronous motor would be ideal. It is now quite common for ring-spinning machines to be driven by individual motors, usually of the high-torque, high-efficiency type, switched direct on to the line by means of triple pole contactors, with or without thermal overload trips, thus reducing starting or stopping to the mere pressing of a button. Within my knowledge, one concern has thrown out 5,000 old fashioned group-driven looms, and installed a like number of individually driven automatic ones.

Wherever an electrical supply is available, the one-man wood-working concern will have a motor-driven combined circular saw, planing, and boring machine, for which it is usual to fit a two-speed squirrel-cage motor, controlled by a mistake-proof pole-changing switch of the contactor type and push-button operated. For the more complicated process machines, as many as thirteen motors may be employed, which are now designed and built in as integral part of the machines. Many wood-working processes demand very high speeds, much above those possible with a 50-cycle supply, and frequencies as high as 250 are obtained by a motor-driven frequency changer.

For very large rolling mills and colliery winders the d.c. motor operating on the Ward-Leonard system is the most favoured form of drive, although the flywheel generator set for this will be driven by an induction motor.

### Machine Tools

Machine tools of all kinds—ranging from the heaviest planer to a hacksaw—are designed with built-in motors. No duty, however exacting, is beyond the scope of even the ordinary squirrel-cage motor; hot, damp, or dirty situations all come alike. Motors for work demanding high starting torque, inching, rapid acceleration and deceleration, quick reversing, and speed regulation are now standard. It is no longer necessary to use expensive, and generally inefficient, totally enclosed machines, since most manufacturers are now producing a modified form of the ordinary protected type of motor for dusty and exposed positions. The modification consists in a two-compartment carcase; the winding and internal parts are completely enclosed in an inner frame, whilst the outer shell is arranged to form ventilating ducts; fans at each end of the motor cause a constant stream of air to flow axially across the outer diameter of the stator stampings, and through the internal diameter of the rotor. Cowls incorporated in the design form a dust trap, and means are provided for removing them for cleaning. The windings and other vital parts are

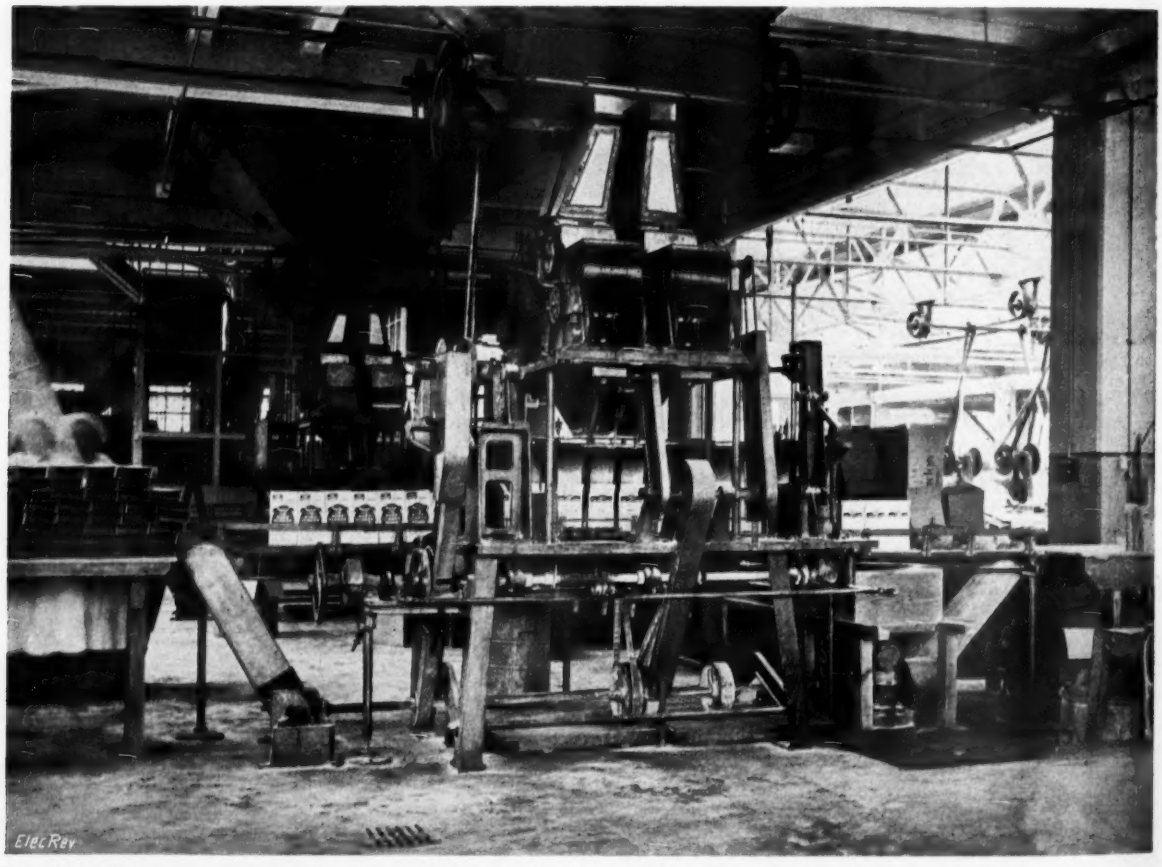


**The use of small motors—wire enamelling machines at Ferranti's works**

thus completely protected, but the motor still retains the features of the common protected or ventilated type. It is not necessary to employ gearing to the same extent as hitherto for speed reduction or to use a long belt drive to prevent excessive slip; jockey pulleys and belt tightening devices are things of the past, due to the advent of the V rubber belt, the use of which permits the driving and driven pulleys almost to touch each other, and transmission efficiency is high. In practice two or more of these belts are employed, according to the power to be transmitted; usually the driving pulley only will be grooved, the driven having a standard flat-face. Such a transmission not only saves space, but also capital outlay, since it often enables a high-speed motor to be used instead of a low-speed one.

### Power Factor Improvement

A considerable reduction in power costs may be effected by raising the power factor of an installation from the neighbourhood of 0.7 to 0.95, whether the installation be large or small. Motors are usually underloaded for considerable periods; this implies a low power factor. In such cases a synchronous motor for improving the condition may be commercially sound, but static condensers can be used instead. These condensers are very reliable, and as they have no moving parts, cost nothing in maintenance, except for such trifling renewals as




**A double feed electrical automatic filling and weighing machine for soap flakes (Boots); doors of electrical contact chambers open**

arcing tips, etc., for the control gear, and they can be purchased out of the saving effected; manufacturers will supply the complete outfit on a deferred payment system, usually over two years, in which period savings are guaranteed to repay the capital expended.

### Control Gear

No startling discoveries have occurred during the past few years in equipment for controlling induction motors, though many improvements in design have been effected. The advocates of the high-torque squirrel-cage motor claim that almost any size of machine can be thrown directly on to the line by means of an ordinary switch. While regulations as to the size of motor that may be switched directly on to the line are somewhat elastic, there are few electricity supply authorities which permit this for machines above 7.5 h.p., and consequently we still have to resort to the star-delta, stator resistance or auto-transformer starter.

If we wish to obtain the maximum starting torque which a motor will give, the choice of starter is narrowed down to the auto-transformer type, since it may be possible to use the 75 per cent. tappings and yet keep within the limits of starting current prescribed by the regulations.

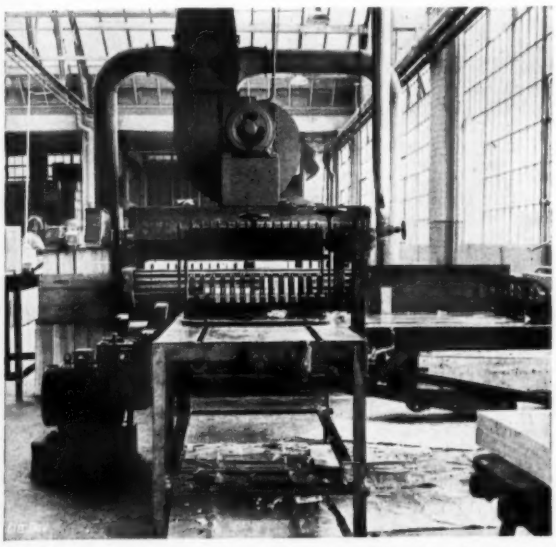
In the case of the slip-ring machine we are confined to the use of a resistance in the rotor circuit. Hand-operated starting gear does not as a rule receive gentle treatment, so that, apart from other troubles which occur as the result of misuse, maintenance charges are high. A combination of contactors may be arranged for direct-on-line, star-delta, auto-transformer, stator-resistance, and stator-rotor switching, thus covering the complete range of starting equipment for all types of a.c. motors. Except in the case of direct switching, two or more contactors are employed; for instance, in star-delta starting, there is one for the line, a second for the star position, and a third for delta. Two or three thermal or magnetic overload trips, a timer, and start and stop push buttons complete the outfit, the complete panel being usually mounted in a sheet metal or c.i. case. Now this type of starter limits human effort to pressing a button for starting or stopping the motor, and what follows is entirely automatic, when the start button is pressed the line and star contactors close, and the motor begins to revolve. Simultaneously with the closing of the line contactor, the timer is brought into operation, and after a predetermined time opens the star contactor and closes the delta contactor. For slip-ring machines the line contactor connects the stator. The number of contactors for the rotor depends upon the amount of resistance cut out at each stage; thus, if the resistance is to be cut out in three sections a contactor and timer are used for each section.

The greater cost of automatic gear for the control of a.c. motors is more than compensated for by its many advantages over hand-operated equipment, such as longer life of contacts, less risk of stoppages and loss of output through misuse, and increased safety. Unfortunately price is in too many cases the deciding factor, but in spite of this, automatic gear is definitely making progress. Needless to say, where full automatic control is necessary by means of thermostat, pressure regulator, float or time switch, etc., only contactor gear fills the bill. Starting equipment is commonly regarded only as a necessary evil, and only the motor (which has become standardised) receives consideration. But it is the controlling gear which makes or mars an installation.

# Electric Power in Soap Manufacture

## A.c. commutator motors improve the power factor

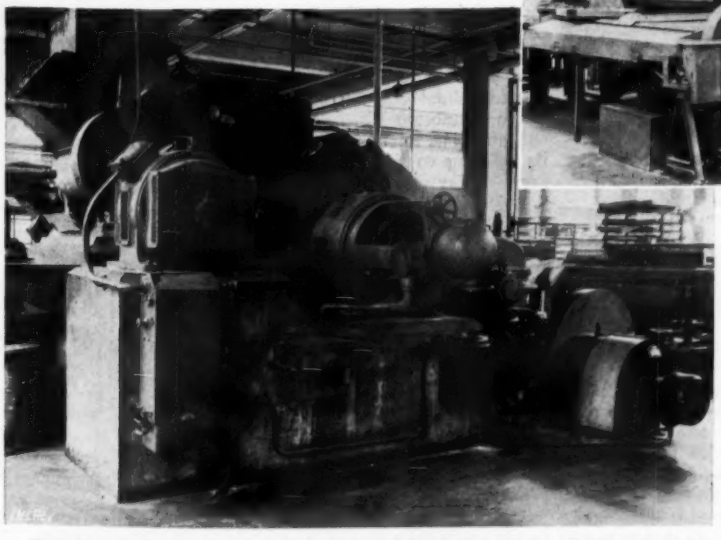
AN outstanding feature of the electrical installation at the new Beeston soap factory of Messrs. Boots Pure Drug Co., Ltd., is the number of a.c. variable-speed commutator motors to be seen, and as these have limits above and below synchronous speed, 1,000 r.p.m., their use results in a much improved system power factor. At the time of our recent visit the p.f. meter in the company's power house (ELECTRICAL REVIEW, May 6th, 1932) registered 0.95. There is a total of 600 h.p. of motors employed on the installation, in units varying from 1 to 45 h.p.



**Household soap-cutter (5-h.p. drive); conditioning chamber in rear with 10-h.p. exhaust fan**

Fats and oils are received at the factory in drums, melted out by steam, and collected in storage vessels. They are then blended and pumped up to the boiling room by three 5-h.p. motor-driven pumps, each of which will deal with 5,000 gal. per hour. These pumps run continuously during working hours, and the soap boilers have their supplies of fats and caustics on tap for immediate serving at any time.

Liquid soap is run off from the boiling pans into storage vessels and then passed through crutching pans and cooling rolls and into drying chambers in which hot air is fan circulated. The rolls and the fans are belt driven by 7½ h.p. motors.



**Two three-roll mills in line with soap plodder; left to right—45, 45 to 16, and 15 to 6-h.p. motors**

The dried chips from the drying chamber go into storage hoppers from which they pass through mixers in which perfumes are added. They are next passed through refining mills. Four mixers are group driven by a 10-h.p. motor, with fast and loose pulleys. The operating parts of the mixers are very efficiently interlocked with the drives to prevent accidents.

The refining mills are designed thoroughly to incorporate the perfumes and colouring, and to provide ribbons of soap with uniform perfume content and colour density for the plodding machines. In these the soap is compressed in a screw conveyor system before extrusion in suitable shapes for the final tablets. Generally two refining mills and a plodder are grouped as one unit, with three separate drives.

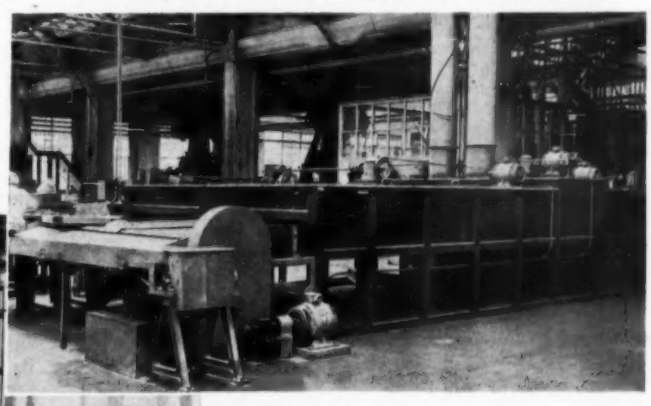
For the group illustrated the first mill is served by a 45-h.p. motor controlled by an auto-transformer starter. Driving the second mill is a 45 to 15-h.p. a.c. commutator variable-speed motor (1,080 to 360 r.p.m.) governed by a direct-on oil circuit breaker. A similar variable-speed motor—15 to 6 h.p., 1,000 to 400 r.p.m.—with similar control, serves the plodder. Variable-speed driving is necessary because the "resistance" of the soap (viscosity) varies with the temperature, low speed being necessary at starting. All three of these motors drive direct on to laminated gearing for speed reduction, and then *via* ordinary gearing.

### Making the Tablets

The extruded material is automatically cut into the required lengths for feeding to tablet presses. Tablets are passed on and endless conveyor through a conditioning chamber, which is illustrated below.

There are a number of interesting small motor drives in connection with the conditioning equipment. Referring to the illustration below, the motor (2½ h.p.) nearest the camera (back of the machine) drives an endless conveyor with a carrying length of about 30 ft. The conveyor speed of one foot per min. demands a tremendous reduction from the motor speed of 1,430 r.p.m.

Three 1-h.p. motors on top of the conditioning chamber provide drives for air-circulating fans, two intake and one exhaust (centre). Although at first this might appear somewhat extravagant, the arrangement is necessary to ensure uniform circulation. All the motors are controlled from the front of the machine by air-break direct-on switch-fuse units. Tablet stamping (trade marks, &c.) is effected on machines driven by three 2½-h.p. motors. A stamping machine will deal with up to 7,200 tablets per hour. The tablets are finally wrapped and packed for despatch. An automatic wrapping machine which will deal with 55 tablets per minute has a 1½-h.p. motor.



**Tablet conditioning chamber; conveyor drive near camera, fan drives on top of machine**

For flaked soap, the chips from the drying chamber pass through five-roll refining mills, each driven by a 30-h.p. motor. One of these motors is an a.c. commutator machine with a speed variation of from 500 to 1,500 r.p.m.

From these mills the flakes are passed to automatic filling and weighing machines. Hopper fed from above, they fall into a balance pan until at a predetermined weight an electrical contact is made by the pan "drop," and this puts solenoids into circuit which close the supply (soap flakes) line from the hopper and open the delivery chute to the cartons carried round on an endless belt beneath.

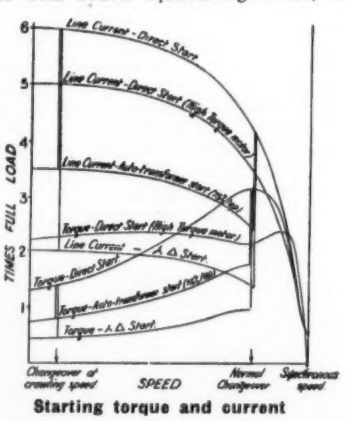
In the household section, after cooling the soap, slabs are cut into bars on automatic machines with two interlocked movements at right angles served by a common 2½-h.p. drive. Most of the motors and starting equipment that we saw were of British Thomson-Houston manufacture.

# Starting Squirrel-cage Motors. By H. B. Poynder, M.I.E.E.

## Restrictions upon direct starting are often unjustified

THE great majority of three-phase motors required for industrial use are of the short-circuited rotor type. The stators are of two types:—(*a*) with permanent star connection; (*b*) wound with more turns of a smaller conductor and six leads brought out, so that they can be started on the star and run on the delta connection. The rotors also are of two types:—(*a*) the ordinary squirrel-cage rotor; (*b*) the high-torque rotor in its various forms, usually with a double squirrel cage winding.

The high-torque motor with double squirrel-cage rotor, or its equivalent, is a comparatively recent development which, at the expense of a slight reduction in efficiency and power factor and a small increase in cost, will give a substantially increased starting torque combined with a small reduction in the rush of current when first switched on. There are special cases where its use is advantageous.


TIMES FULL LOAD
SPEED
Changeover at crawling speed
Normal Changeover
Synchronous speed
Torque - Δ Start
Torque - Auto-transformer start (50% tap)
Torque - Direct Start
Line Current - Δ Start
Torque - Direct Start (High Torque motor)
Line Current - Auto-transformer start (75% tap)
Line Current - Direct Start (High Torque motor)
Line Current - Direct Start
**Starting torque and current**

There are four methods of starting short-circuited rotor machines:—(*a*) switching direct on to the mains, preferably by means of a switch with a snap make as well as a snap break; (*b*) rheostatic starting, *i.e.*, switching on through one or more steps of resistances, either in series with the mains or in the star connection of the stator; (*c*) star-delta starting; and (*d*) auto-transformer starting, which can be either multi-step or two-step—the former is unusual, and the latter only is here considered.

### Starting Current and Torque

The diagram shows typical values of current and torque for direct starting with a standard and a high-torque motor, and for star-delta and auto-transformer starting. Rheostatic starting is not shown on the diagram as it is comparatively seldom used; but in so far as torque is concerned, either the star-delta or auto-transformer curves may be taken, depending on the amount of resistance used; the corresponding current values would be higher, however.

The diagram must only be considered as approximate, since starting torque and current vary with the number of poles, the h.p. of the motor and the degree of enclosure. The position of the normal change-over shown on the diagram probably represents actual practice, as, although slightly reduced shock and current rush at the moment of change-over could be obtained by making it a little later, it may be assumed that the natural impatience of the operator usually results in the change-over taking place in the neighbourhood of the maximum torque position, *i.e.*, at about 80 per cent. of the synchronous speed.

The initial torque with the star-delta start is only some 40 per cent. of full load, and this, in most cases, does not give sufficient margin when the motor is direct coupled to its load, especially after the driven machinery has been standing for some time. In the auto-transformer, on the other hand, the tapping can be chosen to give any required initial torque. A typical setting for industrial use is one which gives about 75 per cent. of full load voltage and about 70 per cent. of full load torque initially. It is this tapping which is assumed in the diagram.

### Mechanical Shock

Examination of the curves shows that the initial mechanical shock is reduced either by the 75 per cent. tap auto-transformer starter, or the star-delta starter, but that when switching over from the starting to the running position, a second shock occurs slightly greater with the auto-transformer start, and much greater with the star-delta start, than the initial shock when direct started. In the case of a motor directly coupled to its load, therefore, the mechanical shock conditions with direct starting are definitely better for the driven mechanism than with either auto-transformer or star-delta starting, since in the last two cases the mechanism is subjected to two shocks instead of one, the second of which is greater than that imposed by direct starting.

On the other hand, where there is backlash present in the drive between the motor and the driven mechanism, the conditions are different, since to avoid a hammer blow, it is important that the mechanical parts should be brought into close engagement before the full torque is applied, and with such drives, rheostatic, star-delta or auto-transformer starting may be used. Minimum shock is obtained if the starting step is only just sufficient to take up the backlash and allow the load to crawl, since the longer the switching over is delayed up to about 80 per cent. of synchronous speed, the greater is the second shock. This early throwover, however, gives practically the same current rush as in the case of direct starting.

The starting shock can also be reduced by the use of a properly designed centrifugal clutch which takes up the load gradually when the motor has nearly attained full speed. This method is probably preferable to any of the switching methods, and the clutches are available at reasonable prices.

### Current Rush

It will be seen from the diagram that auto-transformer starting with the 75 per cent. tap reduces the initial current rush by over 40 per cent., but the second current rush at the moment of switching over will probably be intermediate between this and the direct starting current rush, lasting, however, for a much shorter time. On the other hand, during the whole of the period before throwing over the starter to the running position, the torque developed is of the order of half that with the direct start, and the time taken to accelerate the motor is, in general, much more than doubled. The actual multiple depends on the relative values of friction and inertia in the driven mechanism.

With lower value tappings on the auto-transformer or with the star-delta start, the current during the running-up period is further reduced, but there is a still smaller margin of torque available for acceleration, and the starting period is lengthened to a still greater extent. Many industrial motors are started up at about the same time, *i.e.*, when work begins and after meal hours, so that on a feeder which supplies a considerable number of industrial motors, either to a single works or to scattered consumers, there must be set against the reduction of the current peaks obtained by auto-transformer or star-delta starting the greatly increased probability of motor starts overlapping.

The centrifugal clutch again relieves the situation by shortening the duration of the start, since it allows the motor to run up quickly to nearly full speed before the load comes on, and for two-step starting a star-delta or even a rheostatic start suffices, the more expensive auto-transformer starter not being justified.

### General Conclusions

Direct starting is in general the best and cheapest method from the user's point of view. Any well-made motor will stand it. That the motors are not the limiting factor is shown by the adoption of direct starting up to about 1,000 h.p. in power stations. Whilst it is not contended that conditions will allow direct starting of industrial motors approaching this size, yet in a works equipped with its own sub-station direct starting should be adopted up to as large sizes as possible. When connected direct to a network, however, the supply authority has to consider voltage regulation in the interests of its lighting consumers, and restrictions are definitely necessary. Many of them are, however, unreasonably severe.

Rules appear to have been framed without due appreciation of the large increase in the duration of the peak demand which, in the absence of a centrifugal clutch, accompanies every reduction in its maximum value when obtained by stator voltage reducing methods, such as auto-transformer or star-delta starting. Such methods, therefore, have questionable advantages, even in the case of a single motor, but the position is intensified where a number of motors are involved whose starting periods are likely to overlap.

The extent to which the regulations can be relaxed depends, of course, upon the particular network and the nature of its load, but, in general, if the direct start would cause complaint from lighting consumers, the relief obtained by the use of an auto-transformer starter would be too small to remove the cause of complaint.

The centrifugal clutch has valuable features. It relieves the driven mechanism of shock and shortens the current peak period. When it is used in combination with the star-delta start, the great extension of the starting period that otherwise results is prevented. On lighting feeders and networks where serious inconvenience would result from heavy current peaks, if the centrifugal clutch and star-delta starting cannot be adopted, the employment of repulsion or slip-ring motors seems to be indicated.

# Fractional H.P. Motors. By J. S. Ramsden, M.I.E.E.

## The wide field for their industrial application

THE use of fractional horse-power motors has been encouraged very considerably by the realisation of the advantages of the individual drive for machinery, that is, the saving of line shafting and belting, the economy of space and lighting due to this, and, probably most of all, the saving in power when it is necessary to work one or two small machines only in a large workshop. For instance, a printer frequently works one or two machines after all the others have shut down, in order to complete an order. Probably it is only necessary for a folding machine to be operated, in which case a ¼-h.p. motor is sufficient. Unless he has his folding machine individually driven it may be necessary to run a 30 or 40-h.p. motor in order to operate this small machine.

The development of electrically driven portable machinery, such as tyre inflators, drills, saws, paint sprayers, grinders and shears, has also created a very large demand for these motors in industry. There are applications in practically every trade, even in the brewing trade; fractional horse-power motors are used in public houses for washing, sterilising, and drying up to five hundred glasses per hour. In the laundry they are used for driving marking machines, presses and ironers.

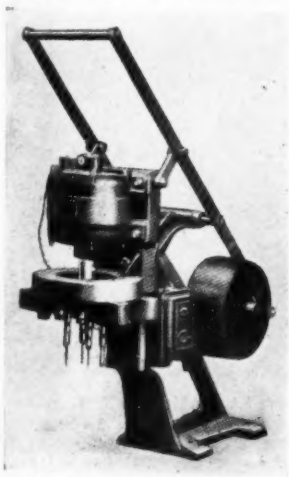
**High speed spindle attachment for milling machine**

The up-to-date garage has its tyre inflator, boring bar for cylinders, brake relining machine, brake testing machine, car washer, valve refacer, all driven by fractional horse-power motors. The dairy trade uses refrigerators, bottle washers, bottle fillers, capsuling machines, separators, again driven by these small motors.

### Types of Motors

In factories there are hundreds of miscellaneous uses for such motors. In machine tool applications the tendency is to use "built-in" motors, as distinct from motors forming complete units in themselves. A built-in motor consists generally of a wound three-phase stator and a squirrel-cage rotor, the most simple and sturdy type of motor made. The machine tool maker is able to fit his own shaft to the rotor, and build the stator into his machine in the way most suited to his design.

If a single-phase supply only is available, the motors can be series-wound, split-phase, or repulsion-start induction machines. Series-wound motors are usually of the universal type, suitable for single-phase or d.c. supply within specified voltage limits. They are only used for very small powers where it is possible to utilise a very high speed, such as in portable drills, saws, or grinders.



**A small multiple-spindle drilling machine**

Split-phase motors have two windings, one for starting and the other for running. At starting these are connected in parallel, the starting winding being automatically disconnected by a centrifugal switch as the motor attains nearly full running speed, when the machine operates as a plain squirrel-cage induction motor. It is suitable for applications where starting torque of not more than 150 per cent. of full load torque is required, and where starting is infrequent.

As the name implies, the repulsion-start induction motor starts as a repulsion motor and runs as an induction motor. It has a wound armature, commutator, and brushgear similar to those of a d.c. motor. The brushes are permanently short-circuited and the stator only is connected to the supply mains. A starting current is induced in the armature and flowing through the conductors and short-circuited brushes a torque is produced, which decreases as the speed increases. By a centrifugal device the commutator is short-circuited when nearly full speed is attained and the motor then runs as an induction motor. This type of motor is ideal, as it combines in one machine the high starting torque of the repulsion motor and the constant speed of the induction type.

### The Capacitor Motor

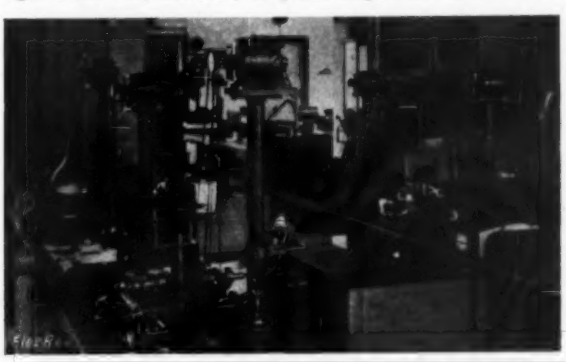
A comparatively recent development is the capacitor motor. This type differs from other single-phase motors, inasmuch as it is actually a two-phase motor which operates on single-phase supply. This is made possible by means of an external capacitor, consisting of a condenser and auto-transformer. By means of a very simple automatic centrifugal switch, built into the motor, the connection from the starting tap to the running tap of the auto-transformer is made at starting, and the motor then operates virtually as a two-phase induction motor.

*[Whitlock & Sons*

**Mr. J. S. Ramsden is manager of the Supply Dept. of the B.T.-H. Co., Rugby**

Direct-current motors are either series, shunt, or compound wound, but the very great majority of fractional horse power motors are compound wound, as this type can be switched direct on the mains without a resistance starter and develop a high starting torque. It should be noted, however, that many supply authorities insist on the use of starters with motors above ½ h.p.

The efficiency and power factor of small motors are relatively low. A ¼-h.p. motor will have an efficiency at full load of approximately 65 per cent., and a 1/40-h.p. motor one of 30 per cent. The full-load power factor can be taken as 55 per cent. on the smaller sizes to 70 per cent. on the larger sizes. These figures are not, however, of prime importance in industrial



**Instrument coil-winding, each bench having its own motor**

applications, where the cost of operating the small motor is only a very small percentage of the value of the output of the driven machine.

### Selection for Duty

The mechanism of electric motors is so simple that any reputable make should give splendid service for years with minimum attention, providing it is carefully chosen for the particular duty for which it is required. There is a deplorable tendency, however, for a small motor to be regarded by the inexperienced buyer almost as a toy, and the important matter of the rating of the motor is frequently given insufficient attention. It is advisable to be liberal when estimating power to drive any small machine. For instance, if the estimated power required is ¼ h.p., then it is better to choose a motor of ½ h.p., as the price will be very little more and the extra cost will be amply repaid by the safety margin obtained.

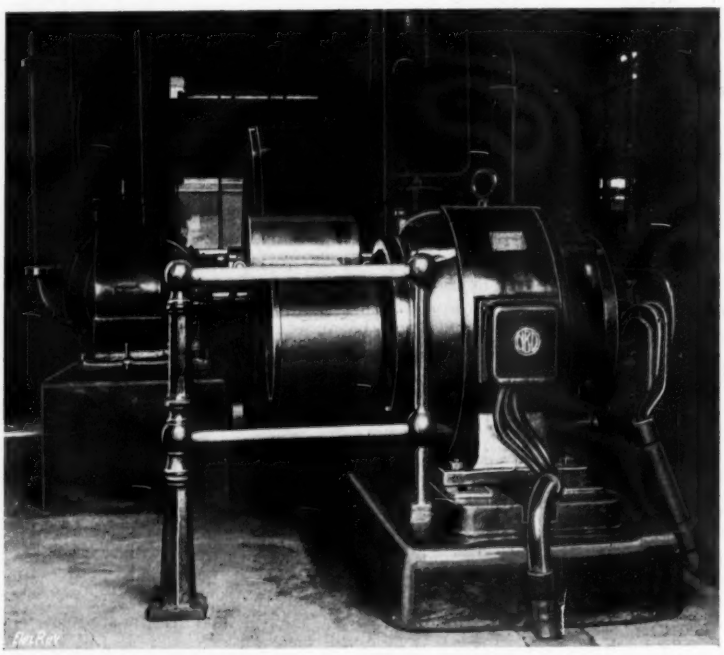
It is a good plan for any machine manufacturer who decides to "motorise" his product to seek the advice and recommendations of a reputable motor manufacturer on the question of power and type of motor required.

It should be borne in mind by manufacturers and users of these motors that it is essential they should be designed and built with the same technical care and skill as the largest machines. Motors of the smallest sizes, even down to 1/40 h.p., must be capable of working under the most arduous industrial conditions for many years with the minimum of attention.

# Electrical Practice in a Rolling-stock Factory

## Standardisation with group driving

WE left the Langley Mill (Nottinghamshire) works of Messrs. G. R. Turner, Ltd., recently with an impression of standardisation in driving units carried out to an extent not too often seen in what might be termed general engineering works. The company produces railway rolling stock and all types of mining machinery, in addition to general engineering equipment, so that its shop apparatus is of the kind with which most of our readers are familiar—lathes, mills, rolls, &c.



A motor-driven air compressor supplying heavy pneumatic hammers

For the classes of work on which the factory is engaged, Mr. W. Hutton, managing director, is obviously an enthusiast for group driving. The company claims that almost any type of mechanical engineering job can be tackled in its shops, which are therefore not laid out for any form of mass production in its wider sense. An essential requirement for individual driving is continuity of demand. Further, group driving renders standardisation in motors much more easily practicable, and the interchangeability of motor parts as a result of such standardisation has proved particularly useful. The widely varying diversity factor of the machines is also an important feature.

Throughout the shops there are 17 motors, representing a total of 444 h.p., of which the three standard sizes, 100, 50 and 25 h.p., are responsible for 400 h.p.

### Steel-working Plant

Constructional work in steel in the main machine shop and erection bay necessitates heavy rolling and mangling, &c., and a set of rolls capable of handling steel plates 14 ft. long by 1 in. thick is group driven with shears and a lathe by a 25-h.p. motor. A motor of the same size was seen driving a heavy straightening machine, cold saws and a drilling machine, while a third similar drive serves a bank of three radial drilling machines, each with eight units, the largest of which will drill up to 2¼-in. holes. Another 25-h.p. drive includes a standard rolling-stock wheel lathe, a hot saw, a drilling machine and ordinary lathes.

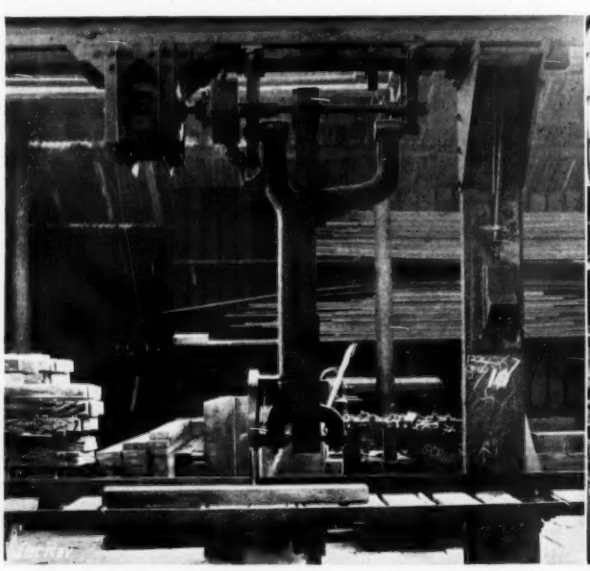
In the smiths' and forge department there are 5-, 10-, and 12-cwt. hammers which have been converted from steam to compressed-air operation with excellent results. It was held that "freezing" troubles with the valves on compressed-air hammers were due to serving the hammers with too large air receivers, the thermal units thereby being lost before the air was used. A comparatively small compressor was therefore installed, with a small receiver in close proximity to the hammers. The compressor will bring 511 cu. ft. of free air to 100 lb. per sq. in. in a minute, and it is driven by a 100-h.p. motor.

### Labour and Money Saved

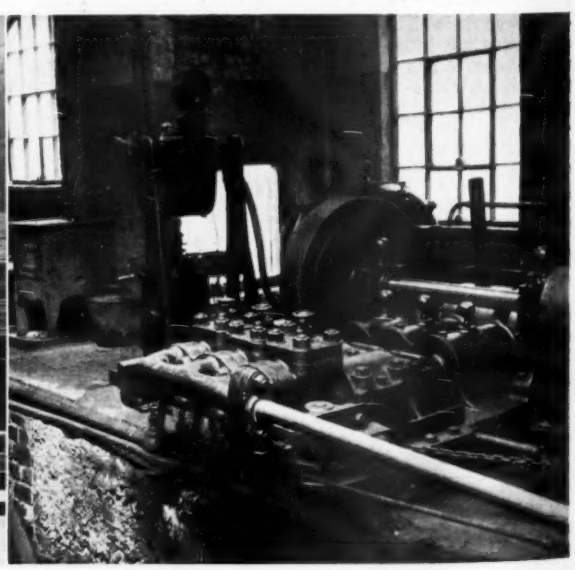
The result has been the virtual disappearance of trouble and considerable economy over steam working by way of labour saving in connection with stoking, &c., for the boilers; elimination of the thermal losses experienced with steam hammers due to intermittent working and the necessary blowing off of the valves; and reduction of running costs, which are limited to the period of working only. In round figures a saving of £300 a year has resulted from the conversion.

Other hammers are steam operated and are served by waste-heat boilers fired by the heat from the forge furnaces. There is a number of large hydraulic presses of the single- and three-ram types supplied by three-throw pumps driven by a 50-h.p. motor. A motor of this size serves directly a line of drop stamps.

In the foundry may be seen a 17.5-h.p. motor driving a cupola blower, and a 7.5-h.p. motor driving a sand mixer and a loam mill, and another 7.5-h.p. drive for shears, &c. The foundry is spanned by a large electric crane from which the cupola loading platform is served by wheeled skips and trams, the crane having such a height as to permit the skips, &c., to be lifted on to the cupola platform. The usual cupola hoist is



One of the pendulum wood saws



Hydraulic pumps served by a 25-h.p. motor

thus avoided, and in consequence there is a saving in labour.

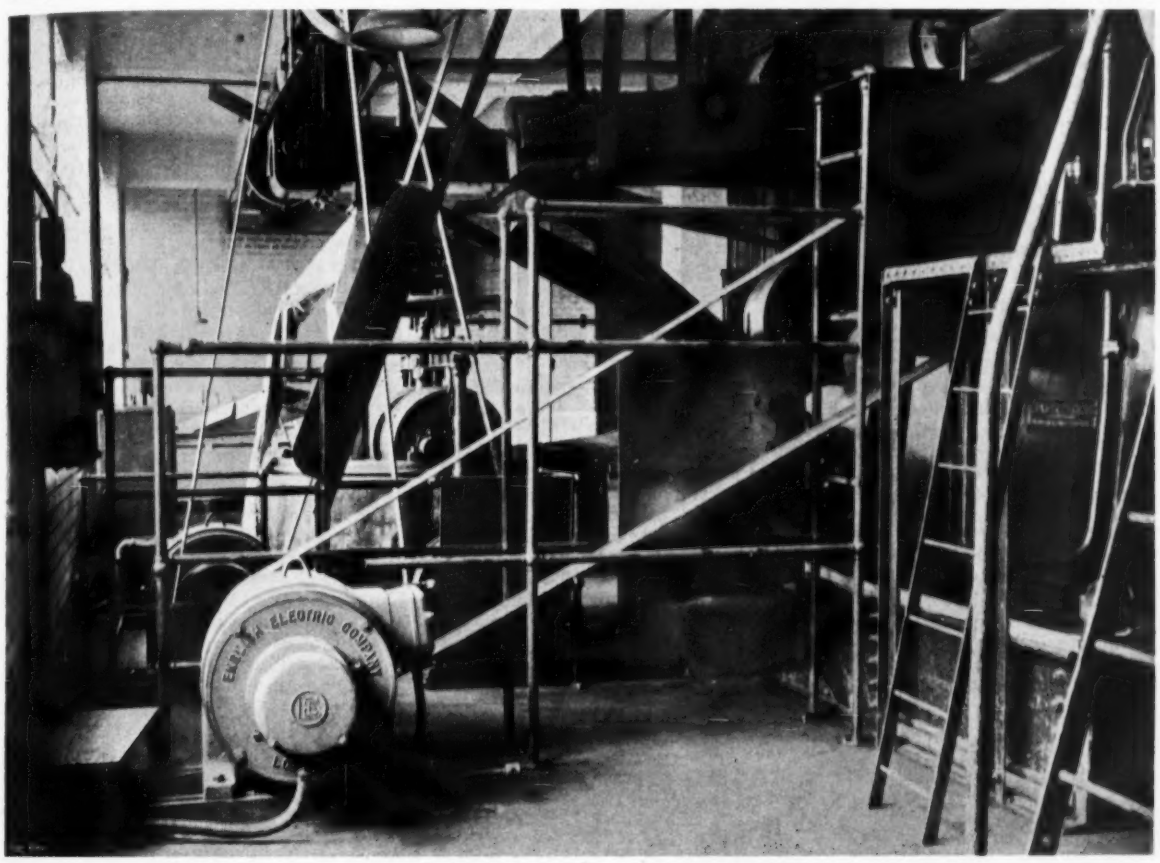
The same principle of electrical group driving prevails in the wood-working department, where there are three 25-h.p. motors driving a four-side planer and thicknesser, moulding spindles, saw benches, mortising and tenoning machines, a boring machine, a band saw, &c. Examples of individual drives in this department include two 5-h.p. pendulum saws, one of which is illustrated on the preceding page.

When discussing the drive for a 25-h.p. double-headed wheel returning lathe in the wagon repair shop, it was good to hear the following point stressed by the consumer: "With the electric drive we can put the lathe where we want it and take the motor to it."

In addition to the foundry crane mentioned, all the shops are similarly served, including a 10-ton crane and a 5-ton crane over the main erecting bay. To facilitate control, these are all equipped with 110-d.c. motors supplied from a 50-h.p. motor-generator. There is a similar m.g. set for stand-by.

Originally the works lighting was supplied by these sets, but it is now 250 V a.c. The difficulty of lighting such a works is having to suspend the main lamps clear of the crane, but good results have been achieved in the main bay by hanging 500-W Ediswan reflectors from the principals above the crane, with local units over the machines. The same difficulty in the foundry was added to by reason of there being no opportunity for local lighting. The solution is reflectors on the crane columns at 45 deg., with very satisfactory results.

An indication of work still to be done is the existence of an old gas engine (still working), and a number of petrol tractors. An opportunity for the electrical industry also exists in connection with the foundry furnaces. A 2-h.p. motor drives a compressor for the gas delivery, by the way.



**Electrically driven cocoa grinding and mixing machines at Cadbury's Bournville works**

# Workshop Handling Equipment. By F. E. Chilton, A.M.I.E.E.

## Cranes and hoists for loads up to ten tons

WORKS handling equipment is generally governed by three prime factors: (1) nature of product; (2) capacity for production; and (3) architectural facilities. Overall efficiency will depend on many factors. Light tackle for light lifts and full-speed running, whenever permissible, is just as important as high power-factors and machine efficiencies. Although the average power consumption of crane plant is low, considerable savings can frequently be obtained through periodical inspection, which reveals incipient structural defects, such as excessive deflections, mis-alignment of track rails, loose joints, and other unfavourable frictional and vibrative conditions likely to cause overloading of motors and more or less serious stoppages.

In constructional works, machine shops, and foundries, the bulk of the hoisting and placing of work is done by overhead travelling cranes. D.c. is unquestionably the best, and may be necessary where fine speed-torque regulation is important; it is employed in some seventy per cent. of the total applications for this class of service, but for ordinary purposes polyphase a.c. is generally satisfactory.

For commercial cranes, the principal types of motors employed are the d.c. series-wound, and the polyphase induction motor with wound rotor. They must withstand shocks and stresses, due to frequent starting, stopping and reversal on load, and be capable of exerting at least 200 per cent. of full-load torque at starting. Low speeds and minimum inertia of armatures are necessary for rapid acceleration and reversal on heavy load.

The characteristics of these machines differ considerably, the series motor having a variable speed and being capable of accelerating 200 per cent. or 300 per cent. for light duties, whilst the induction motor is of the constant speed class, varying in slip from about 5 per cent. to 8 per cent. The advantages of the series motor are that its torque varies roughly as the square of the current and directly as the applied voltage, whilst that of the induction motor varies directly as the current and as the square of the voltage. Commercial slip-ring crane motors* generally yield 200 per cent. torque at approximately 250 per cent. current at starting, and have a break-down torque of about 250 per cent., all of full load values. In overload capacity d.c. motors are, therefore, superior, their limits being determined by excessive heating or mechanical failure.

As squirrel-cage induction motors have non-variable rotor resistances they are unsuitable for speed-torque regulation,

* British Standard Specifications, Nos. 168-1926, and 118-1923.

but for duties not requiring fine speed control and powerful torque they are satisfactory. They are exceedingly robust, and, with "high torque" rotors, their mechanical advantages and simplicity and economy of controlling and wiring equipment warrant their extended use. Single-phase motors of the commutator-series or repulsion types, although characteristically suitable for hoisting duties, are relatively heavy and expensive. Small motors of this type might sometimes be used where fine regulation and creeping speeds are required to an extent comparable with these attributes of direct-current armature diverter control.

Mr. F. E. Chilton

## Speed Control

Controllers for crane service,* within the limits of size under discussion, are usually of the hand-operated drum type, constructed especially for speed regulation and reversing under load. Semi-automatic relay and contactor control is not necessary for the operation of the relatively limited ratings here discussed. Crane resistances are generally of the coiled wire or grid-pack construction, anti-vibrative, and preferably of the non-breakable and non-corrodible metal pattern.

Speed variation of d.c. series motors in either direction below normal is obtained by: (1) plain series rheostatic control; and (2) dynamic and potentiometer control, the motor operating as a generator and the current producing a torque which tends to resist overhauling of the motor by its load. With the dynamic control employed on powerful cranes, where the hooks are practically always loaded with heavy ladles or grabs so that there is a constant overhauling tendency, the armatures generate in strong separately excited fields, returning a proportion of the current to the supply system.

## Potentiometer Control

Potentiometer control combines the dynamic principles with a modified arrangement of power circuits between the motor and controller, and gives a remarkably flexible and self-adjusting means of controlling the heaviest loads. The system automatically either takes or generates current, as the load is driven, or has a tendency to overhaul the motor. Series, shunt, or compound speed-load characteristics may be obtained from a series motor.

The circuit for hoisting is normal, with the armature in series with the series field and the brake solenoid across the mains and starting resistance. For lowering, the series field is separately excited, the armature being shunted across the series field and solenoid with special resistance. Thus braking currents are generated in the constant field, enabling loads to be lowered at high speed under definite and accurate control. It is possible to lower a load with precision after the line supply has failed owing to the dynamic braking circuit being self-dependent. For "inching" and extremely fine adjustments of certain work in foundries and machine shops, a dead-slow speed may be obtained by short-circuiting the motor armature through a variable resistance, which diverts current into the series field to the extent of affording it separate excitation.

Speed variation of induction motors is usually obtained by means of a variable rotor resistance, increasing which reduces the angle of lag of the rotor currents, thus increasing the torque for a given stator current; this method ,like rheostatic control for d.c. machines, is wasteful.

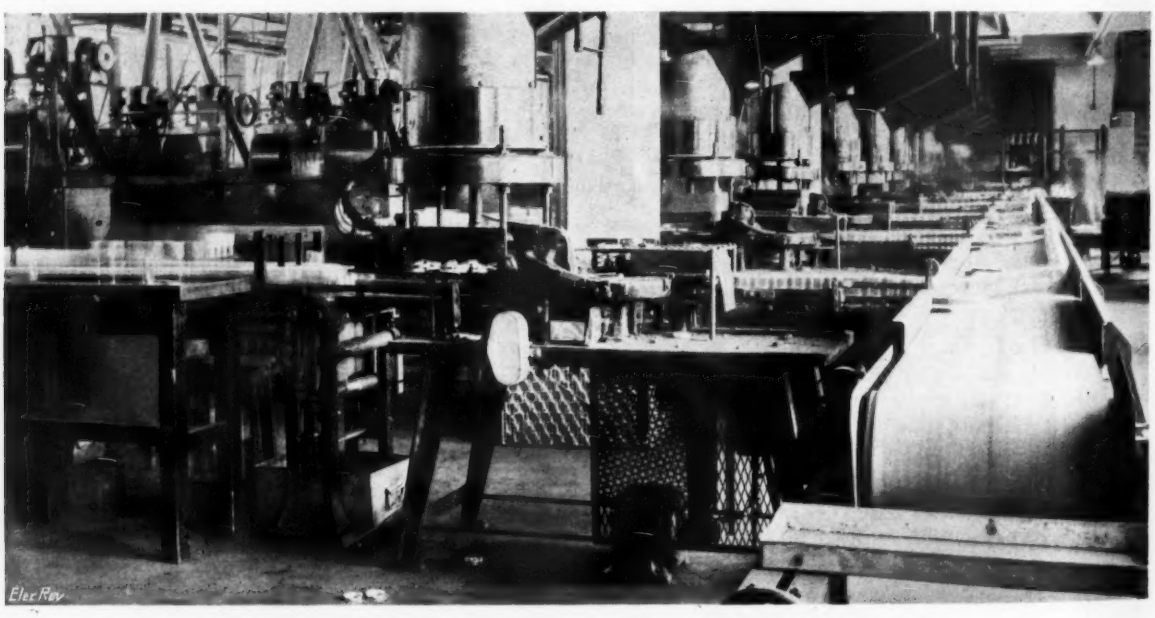
Various speeds, from full speed to stop, with any torque up to at least full-load starting torque, can be obtained by the rotor resistance control. At the same time, the line current for any definite load will remain approximately the same, regardless of the speed. The speed of "high-torque" squirrel-cage motors can be graduated by employing auto-transformers, but the torque thus obtained is altogether inadequate. To start effectively on load, such motors are switched directly on to the line.

## The Braking of A.C. Motors

Induction motors are electrically braked by using stator currents to oppose rotation during overhauling. A powerful control is effected by varying the resistance in the rotor circuit. As this resistance is cut out, the speed is correspondingly reduced until the machine is practically at a standstill, when the motor is disconnected from the line to prevent reversal and the solenoid brake takes charge of the load. Solenoid brake coils for d.c. are either shunt or series wound, but for a.c. they are shunt wound only. Except for small motors of 3 b.h.p. or less, when shunt coils are best, series coils are desirable, as they are more robust, have less self-induction, and a low potential between turns, simplify wiring, require no discharge resistances, and are less expensive.

A solenoid brake must act instantly. Commercial design allows for lifting when hot, at 90 per cent. of rated voltage for shunt coils, and for series coils 60 per cent. and 30 per cent. of full-load motor current for lifting and holding, respectively, except for potentiometer control systems, where, in certain conditions, 40 per cent. of current suffices. Solenoid-operated brakes are usually only fitted to workshop cranes for motions that have a tendency to accelerate under load as in a hoisting mechanism. The mechanical efficiency of such hoisting units for moderate power and speeds is about 66 per cent., so that where series solenoids are used, approximately 30 per cent. of load current will pass to hold up the brake while driving down a light hook.

Although I have dealt with the principal drawing and control features of modern workshop cranes, there are, of course, numerous items in the category of switching and wiring accessories which it has not been possible to include. Also, in some instances apparatus referred to may go a little beyond the strict limits of the equipment of cranes of the range and capacities stipulated.




At the Bourneville works: cocoa weighing machines (right) and lidding machines

# Electric Industrial Trucks. By T. E. Dimbleby, A.M.I.Mech.E.

## The latest developments in small battery vehicles

IT is only during the last five or six years that the struggle for supremacy between battery and petrol-driven trucks in industrial usage has become acute. Before this time the handling of materials in industrial plants, by battery trucks had reached a high degree of perfection and great savings had been effected by firms who had taken advantage of the facilities offered by machines with power-elevated platforms, working in conjunction with load-carrying stillages. These elevating platform trucks were as much an advance upon the fixed platform type as the latter was over the wheelbarrow.

**Mr. T. E. Dimbleby specialises in the subject of mechanical handling equipment, and has had 14 years' experience of power-operated trucks**

The advent of cheap petrol trucks, and the misconception that the small outlay ensured cheap transport, resulted in a considerable flow of work from the light capacity electric to petrol vehicles, and in addition much simple transport was allocated to them in circumstances unsuited to the use of battery-driven machines.

The present impracticability of petrol-operated, power-elevating trucks, and the unfavourable results obtained with them by users who now have experience of both types, leave the electric truck still strongly entrenched, but it is recognised that there is a definite sphere of usefulness for the petrol-driven machines. The prospects for electricity are safe so long as purchasers recognise that the real object in using trucks is to cut down manufacturing costs, and that this end is not necessarily achieved by judging the equipment solely on its price.

### Where the Electric Truck is Supreme

Generally speaking, the chief result of petrol truck competition has been to stimulate interest in power trucking as a whole, and whatever losses the electric truck business has sustained have been more than compensated for by the increased call for them for cases in which the petrol truck cannot compete. In this category are to be found trucks with electrically operated cranes, vacuum cleaners, box and barrel handling mechanisms, tiering gear, &c.

Much interest is at present centred about tiering trucks, in which the load platform rises to five or six feet from the floor. Such machines can lift loads into the body of a road vehicle, load dies into presses and stamping machines, expedite the loading and unloading of railway wagons, and generally handle loads up to two or three tons under conditions for which the normal 4½-in. lift of the ordinary elevating truck is insufficient.

Still greater heights of lift are possible with stacking machines, which can place goods to a height of twelve feet or more. These trucks supersede overhead cranes for warehouse work, and can stack up to, and between, the roof trusses; for this reason a shortage of warehouse accommodation can be overcome by substituting stacking machines for the gantry cranes, thereby leaving free for storage purposes the operating space required by the cranes. An interesting feature of these high-lift trucks is that the falling loads are electrically controlled; the hoisting motor is operated as a dynamo and the current generated is returned to the battery, thus avoiding braking losses and effecting a measurable overall economy in energy consumption.

### Economical Operation

In these days of specialised handling equipment, the choice of a system for any particular set of conditions requires close attention if minimum operating costs are to result. The exceedingly economical operation of battery driven machines and their adaptability and freedom from trouble under arduous conditions, make it imperative that their possibilities should be appreciated fully. It is not easy to generalise, however, and deductions drawn from the service of machines already in use need careful checking if they are to be used to forecast results under different conditions of layout and work.

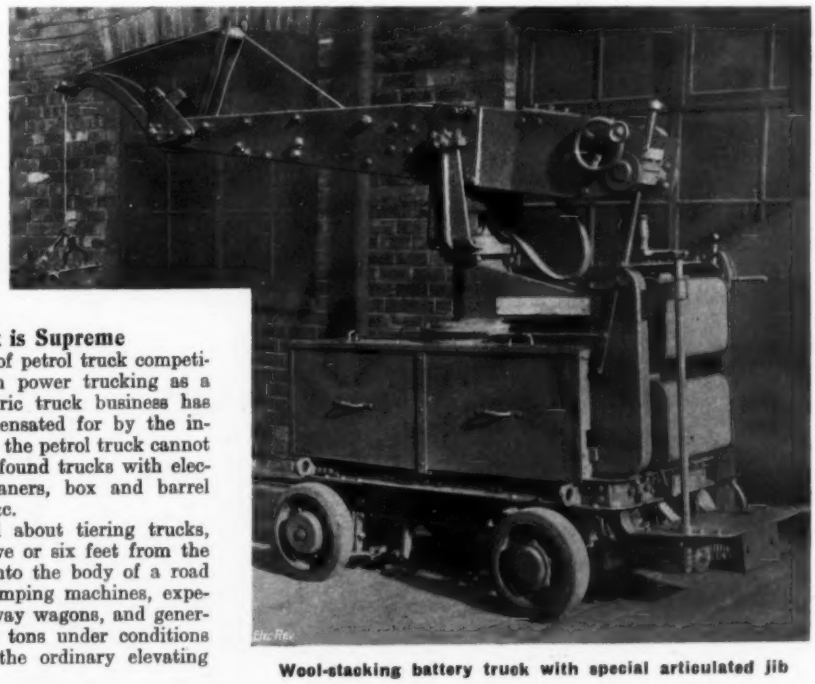
### Comparative Estimates of Cost

Estimates of comparative costs cannot be based upon figures emanating from abroad, where conditions may be totally different. An instance of this was provided by comprehensive comparisons issued by an American petrol truck manufacturer to prove the superiority of his machines over electric trucks. By taking the various costs and modifying them to suit English practice and prices, the electric vehicles show to greater advantage than the petrol machines!

Subject to the foregoing limitations, certain approximate costs may be used in the preliminary estimates for trucking equipment. These figures must of necessity refer to the cost of running the trucks, because no two works are likely to achieve the same, or even approximately similar, figures based on ton-miles, or tonnage. The figures tabulated below represent the approximate total annual operating charges—standing charges and running costs—for the respective machines, and cover everything except the wages of the driver:—

Fixed-platform trucks, 2 tons, £80 per annum.
Elevating-platform trucks, 2 tons, £85 per annum.
Tiering platform trucks, 2 tons, £130 per annum.
Crane truck, carry 30 cwt., lift 10 cwt., £130 per annum.
Stacking machine, £200 per annum.

It is not usually necessary to apportion specific cost against a truck for the charging of the battery; with normal care, only periodical attention is required, and this is covered in the figures given. If a charging set has to be debited to the account, the cost will be increased by about £5 per annum.



**Wool-stacking battery truck with special articulated jib**

The work of which an electric truck is capable varies considerably, and an estimate involves variable factors such as time taken to load and unload under the particular conditions, gradients, length of run, load to be carried, &c., data that can seldom be provided by the prospective customer. Yet it is most desirable that either by trial or by investigation some idea be obtained so that a suitable size of battery may be provided.

It is disastrous to have a battery run down during working hours, especially when a little foresight would prevent such an occurrence. A battery is simply a reservoir holding a definite amount of energy—not a box which has the happy knack of making the truck to run for a day under any and all conditions. Hence, if satisfaction is to be obtained, care must be taken to employ a battery of ample capacity for the day's work, or one that will hold out until it is convenient to change it.

For heavily worked vehicles, it is preferable to use two interchangeable batteries and change during the mid-day stoppage, instead of one large battery which will last the whole day. The saving in weight carried will materially reduce the cost of tyre maintenance, spares, and general wear and tear.

# Making Envelopes Electrically

A VISIT to the Birmingham envelope works of Messrs. Windebank & Co., Ltd., leaves one with the impression of enormous production from small electrical loading. True, the envelope is a small and simple affair, but in a few hours we came to talk with our guides in millions, and the largest motor we saw in the installation was of only 10 h.p. capacity.

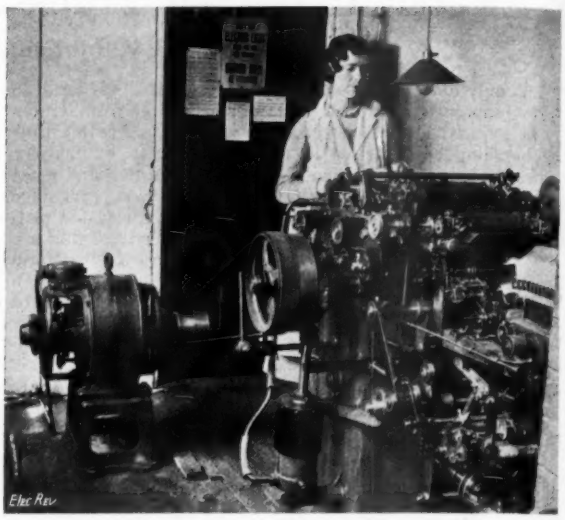
Paper is received at the factory specially sized and shaped to avoid waste in production, according to the sizes, shapes and classes of envelopes to be made. The first essential operation is cutting the blanks from the paper sheets. Specially shaped "knives" are pressed through quantities of paper between the platens of press-type machines. The knives have an average depth of 2¾ in., and they cut blanks from a half to one ream of paper (260 to 520 sheets) at a time, according to the quality of the paper.

To illustrate the power required for this process, one group of ten machines is driven by a 7½-h.p. motor, 610 r.p.m., which also serves a gumming machine used in a subsequent process. Generally speaking one operator can cut on one machine in an ordinary week over a million envelopes, which sounds like a very good week's work.

## Gumming the Edges

In some cases gumming is a separate operation, while in others it is part of a series of operations in which the complete envelope is produced from the blank. For the separate operation two types of machines are employed, one for gumming all over the flap of the envelope, and one for edge gumming. Drying the gum after its deposition is an important process carried out on each machine, and it is effected by directing hot air in required channels by a fan driven either from the motor which serves for the actual machine drive, or from a separate motor.

An edge-gumming machine employs a 3-h.p. variable-speed 600 to 1,100-r.p.m. motor for the machine drive, and a 2-h.p. 1,250-r.p.m. motor for the drying blower. This type of machine will gum from 20,000 to 24,000 envelopes per hour.

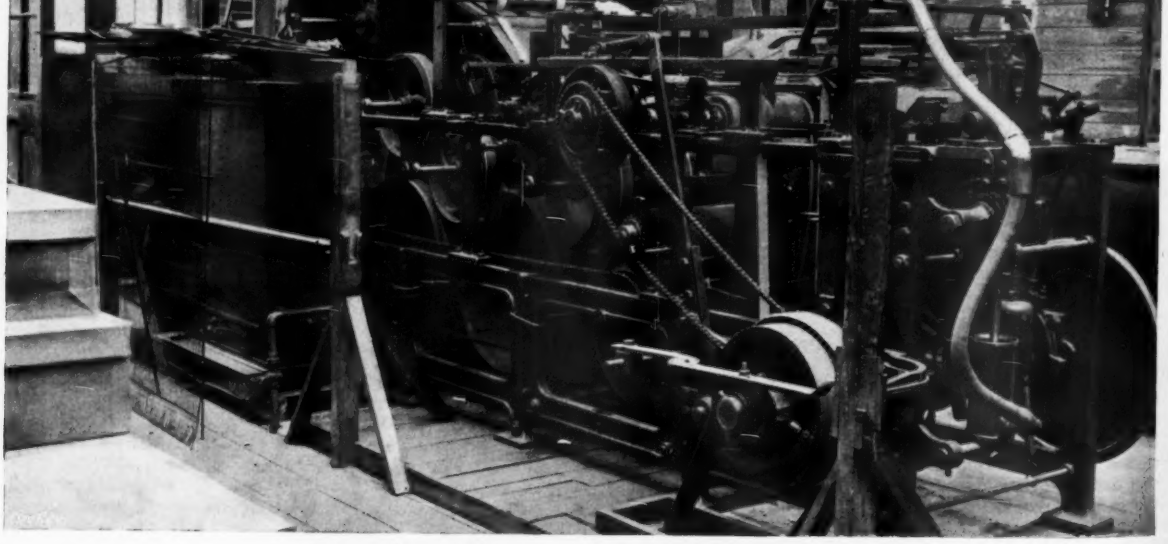


Individually driven rotary envelope machine

for the plunger and individual drive for the rotary machines. One bank of 17 plunger machines is driven by a 10-h.p. motor, 1,050 r.p.m. The outputs of these equipments vary considerably, according to the qualities and sizes of envelopes produced. A machine in this bank is fitted with a special attachment by which envelopes are produced complete with transparent windows on the faces at the rate of 120 per minute. On a rotary machine served by a 2-h.p. motor, 420 r.p.m., the operations of folding, gumming, drying, and counting in lots of 25 each, are effected for a production output of about 250 commercial envelopes per minute.

## Printing

Printing is an important part of the work, and on one rotary machine envelopes are printed in the blank at about 12,500 an hour. This machine is one of a line of nine sets



A gumming machine—one unit of a compact group drive

A machine of the other type (gumming all over the flap) employs a 2-h.p. variable-speed motor, 750 to 1,500 r.p.m., which serves for both operations—drive and air blast. Incidentally, it is worth recording that one of these machines was made on site by the company. Owing to the greater area of gummed surface to be dried on the latter type of gumming machines, they run at lower speeds, and the normal production is about from 5,000 to 6,000 envelopes of all sizes per hour.

There are two types of machines on which the gumming is effected in conjunction with the envelope making (*i.e.*, folding, etc.)—rotary and plunger. Group-driving is employed of various types and sizes, in addition to cardboard-box making machines, served by a 5-h.p. motor running at 1,100 r.p.m.

Because of the variable-speed requirements d.c. motors are employed throughout, and the supply is received from the Birmingham undertaking at 220/440 V. Extreme simplicity is an outstanding feature of the electrical installation, and the company's engineer, an old "steam man," made much of the cleanliness of the modern drive and the fact that he so seldom experienced breakdowns. About the only time that an emergency cut-out governing the whole installation is used is on Armistice Day.

# Communications in Industry. By W. Cruickshank, M.I.E.E.

## The conference system, the Teleprinter and staff location

MOST of the large soft goods and general stores have recognised the need for quick means of intercommunication and have installed private branch telephone exchanges, several of which are equipped with special facilities for enabling the general manager to call up and issue instructions simultaneously to the departmental overseers, but the necessity for similar equipments has not yet been realised to the same extent in the industrial world.

The Research Section of the Post Office Engineering Department has recently devised a conference system of communication, which goes farther than that indicated above and by means of which the public address system can be applied to meetings of directors or managers, who, seated round a boardroom table, can discuss ways and means together and at the same time be assisted in their deliberations by absent members of the board.

**Mr. W. Cruickshank was until recently in the Post Office Engineering Department**

The absent representatives' remarks are amplified and reproduced by a loud speaker of the ordinary radio broadcasting pattern. The meeting can use a common microphone or, better still, each member may be supplied with one and also a key which he can turn when speaking. An ordinary carbon microphone of the type used in the new hand-telephone set gives surprisingly good results on a good loud speaker not overloaded.

Such an arrangement is admirably suited to the needs of the firm whose office or sales department is situated in town or at some considerable distance from the works. A definite policy or a new constructional method or improvement can thus be discussed and agreed upon in the course of a short meeting.

### The Private Branch Exchange

Such a system requires supplementing by a telephone private branch exchange, preferably of the automatic type, to provide for rapid and efficient communication between the shops, or between the separate rooms of the office where the suite is a large one. Such exchanges can be arranged so that, while internal communications are universal, only certain important points are connected to the public telephone system.

A small manual switchboard is usually supplied with these equipments which is operated by a girl attendant for the purpose of distributing incoming calls. It is false economy to utilise the services of a young unskilled and untrained girl for this purpose. A private branch exchange operator (in addition to possessing the skill of a public exchange operator who works on a routine basis) has to be thoroughly acquainted with the ramifications of her employer's organisation, to know

**Page teleprinter, cover removed**

most of the important officials in the firm personally and where they are to be found, and also where classes of work are done and material situated.

Smaller private branch exchanges, say, with two or three direct exchange lines, can be attended safely by an operator on a part-time basis, but she should still possess an adequate knowledge of the business.

### The Teleprinter

Recent developments in telegraphy have produced a means of communication which should be of great value in cases where corroboration or confirmation of the spoken word is required. Messrs. Creed & Co., Ltd., have developed a typewriter telegraph which can be used by a typist with very little extra practice. This instrument, the "teleprinter," has been introduced on many important circuits with great success by the G.P.O. telegraph administration. It has supplanted Morse and Baudôt sets and is revolutionising telegraph practice—another case of the skilled handicraftsman having to succumb to the accuracy and efficiency of the machine.

The first sets, Teleprinters No. 3A, printed on a slip somewhat similar to that of the Exchange Company's tape machine, the tape being gummed on to a telegraph form for delivery. Later machines, Teleprinters No. 7A, print direct on a page. The latter are now being offered to the public on a rental basis.

The apparatus is suitable for working duplex, *i.e.* for sending and receiving messages simultaneously, or, alternatively, up and down working can be done in turn and in this case a home record of the sent message can be made. In duplex working, a second receiver is required for home records. The printing mechanism is driven by a small electric motor which can be started from the transmitting end, so that a message can be received although the typist may not be in attendance at the receiving end. The whole set can be plugged into the electric supply mains, and a rectifier of the copper-oxide type with a transformer with tappings to provide power for the motor, and for line and local currents, is supplied for a.c. systems.

The machines can be used alternatively with a telephone either on private wires connecting the premises of renters, or on a telephone exchange line, a switch being provided to change over from speech to telegraph. Arrangements are made at

**Operating a teleprinter**

the Trunk exchanges to convert the 7½ unit d.c. impulses, combinations of which form the letters, into a.c. impulses in order to meet the requirements of the existing telephone repeaters. The police service is taking advantage of the facilities offered by the system, headquarters, divisional and local offices and even police boxes being connected up. The machines are capable of being operated up to some sixty words a minute.

### Staff Location

One other electrical signalling arrangement is required in a big works, in addition to the ordinary house bell systems, and that is some method whereby important members of the staff whose duties cause them to move about the shops can be located readily for telephone or personal calls.

There are several systems available, the best being those controlled from the manual switchboard associated with the automatic private branch exchange. When no answer is received from the normal telephone point, the operator can send out series of impulses which first cause a siren or Klaxon horn to sound in all shops—as described in the ELECTRICAL REVIEW of April 29th (p. 639)—and then light a coloured lamp or sets of coloured lamps, or distinctive indicators can be displayed, which can be seen throughout the shop.

Each individual has associated with him a known colour or combination, so that everyone knows who is wanted. An answer on the nearest telephone clears the signal and speech follows. All the automatic telephone manufacturing firms are prepared to install such a system.

# Electric Welding and Riveting. By E. W. Lewis

## The coming of automatic methods

DURING the last few years arc welding has received considerable attention and new types of plant include automatic heads, travel carriages, and continuous feeds. Recently, riveted joints have been strengthened by welding, as, for example, in the reinforcing of lattice girder connections.

Official approval is still withheld from pressure vessels which have to withstand high temperatures, but welded boiler drums are in extensive use on the Continent and in the United States. The British Standards Institution is at present collecting and correlating data on the subject.

Autogenous fusion welding has been found suitable for joining aluminium, but riveting is to be preferred for its alloys.

Welding members of a steel-frame building

Difficulties previously experienced with the welding of copper have been largely overcome by the introduction of a copper-alloy filling rod and a flux of desirable properties. Vessels which previously had to be forged from solid copper blocks can now be built up of electrically welded sections. The chemical composition of the weld must be identical with that of the plate and the mechanical characteristics of the plate must be reproduced in the weld. The British Committee on Welded Containers, as the result of extensive research work, has drawn up specifications covering the material, manufacture, filling ratios, working pressures, and hydraulic tests for welded drums and wagons.

### Nickel and Its Alloys

Nickel has been found to absorb gases readily from a sulphurous atmosphere during annealing operations, forming eutectic bodies which eventually tend to cause brittleness. Hammer welding now finds no application in nickel jointing, mainly because it is difficult to remove completely the surface layer of nickel oxide.

Researches into the strength of nickel welds by oxy-acetylene and metallic arc welding have given the following results:—

| Method used. | Condition of weld. | Fracture Stress. Tons per sq. in. | Elongation across weld on 2 in. | Joint efficiency. per cent. |
|---|---|---|---|---|
| Oxy-acetylene .. .. | Dressed | 21.0 | 20.4 | — |
| Oxy-acetylene .. .. | As made | 32.1 | 34.5 | 96 |
| Metallic arc .. .. .. | Dressed | 15.8 | 8.0 | — |
| Metallic arc .. .. .. | As made | 33.0 | 32.1 | 98 |

Low carbon steels with low conductivity and high heat expansion are more easily welded than high carbon steels, and chrome-nickel steels of high nickel content than those of low nickel content. For corrosion-resisting steels it is advisable to use a coated rod, applying reverse polarity in order to eliminate magnetic disturbances; the whole operation should also be conducted with rapidity and with the minimum amount of puddling.

Spot welding (which avoids weakening the metal by punching and drilling) is 60 per cent. stronger than riveted material of 18 to 20 S.W.G., and of about equal strength in ⅛-in. material.

In ship construction riveting is still generally used in this country; apart from the *Fullagar*, the two German "pocket battleships," and a few smaller craft, there is no authentic information that riveting has been materially superseded in the construction of large ships.

Electric welding has been used for attaching parts of the hull structure of two 12,000-ton motor liners recently built in Germany for the Hamburg-Amerika Line; this has resulted in an economy of 200 tons of metal.

Lloyd's Register and the British Corporation of Shipping have issued new regulations for ship welding. Flanges may now be welded on to steel tubes in certain cases for pressures up to 100 lb. per sq. in., which effects a considerable economy in time over the older method of screwed flanges.

Electric welding has also offered a solution to engineers faced with the problem of coping with increased traffic loads over steel bridges and with depreciation due to corrosion.

### Alternating Current Welding

The newer types of a.c. welding plants include a transformer provided with means of regulating the current within narrow limits and a subsidiary oscillating circuit which stabilises the arc and maintains its path in a state of continuous ionisation.

During the past year extensive studies at the Lehigh University, U.S.A., on metal transference in overhead welding have shown the difficulty of maintaining an iron arc even in an inert atmosphere, without the presence of oxides; this phenomenon is inadequately explained by ionisation, thermionic emission, or high potential gradient at the cathode of the arc.

Other problems which have been studied are: (1) the stresses which occur in welded and riveted structures together with the influence of cutting rivet holes; (2) the possibility of electrolytic activity giving rise to corrosion in welded vessels in chemical works; and (3) the behaviour of welded structures under fatigue stress conditions, which have been shown not to differ fundamentally from that of a riveted or forged metal.

The theoretical studies of the highest practical importance are those relating to the testing of welded work. The application of electro-magnetic devices to weld testing, as developed by Sperry, has been an outstanding success, particularly in the detection of transverse fissures. Sonic and stethoscopic methods, depending on the resonating characteristics of a metal structure, are promising results of great practical value to the welding industry.

Gamma ray radiography possesses some advantages over X-ray methods, in that it has more power of penetration, but it suffers from the defects associated with the presence of traces of radio-active substances, yet for structures beyond 4 in. gamma ray radiography is the only practical and satisfactory method available. For the routine testing of welds the gamma ray method is impracticable, due to the characteristic long exposure, a feature which is now engaging the attention of one of the photographic research associations, which hopes to arrive at a suitable method.

### Striking Examples of Welded Work

Among the more striking recent applications of welding technique are the construction of the hydro-electric pipe lines in the Lochaber hydro-electric power scheme, which consisted of double pipes 3,200 ft. long and 5 ft. 6 in. in diameter, with a total incline of 600 ft.; the 11-mile reinforced concrete water main of 60-in. fabricated pipe at Denver, Colorado; and three oil storage tanks in Kent which have a capacity of 3,000,000 gallons.

At a recent meeting of the American Institute of Electrical Engineers a completely self-contained arc welding generator was exhibited, from which the external reactor, regulating rheostats, and exciters have been eliminated. The machine is thus enabled to respond readily to changes in external resistance.

Future advances in welding are to be looked for in the increase of speed of welding (in which the coated electrode with high current densities will play an important part) and the establishment of reliable and simple weld-testing methods in order to ensure public confidence.

# A Tar Macadam Works

IN the following account of the operations and electrical applications at the tar-macadam works of Messrs. Constable, Hart & Co., Cawdor Quarries, Matlock, Derby, we hope to emphasise that the electric drive is second to none, particularly for consecutive manufacturing processes.

Limestone in pieces up to 2½ tons each is received from the adjacent quarry in five-ton skips which are hauled up an incline of about one in three to the main breaking plant. The winder is driven by a Mather & Platt 90-h.p. s.r. totally enclosed motor, 940 r.p.m., controlled by an Ellison oil-immersed rotary starter, and will haul a fully loaded skip up the 100-yd. incline in 1¼ min. The skips are tilted for tipping into the breaker by a small travelling crane driven by a 7½-h.p. s.r. motor served by an Allen West reversing starter.

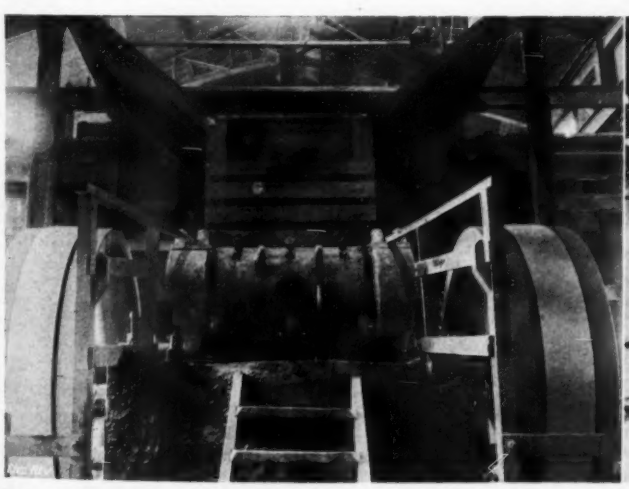
The main breaker has fast and swing jaws which reduce the stone to from about 9 to 6 in. maximum. It is driven by a 250-h.p., 2,000-V, s.r. Crompton motor controlled by an oil-immersed rotary starter by the Electrical Apparatus Co., Ltd. There is a rope drive from the motor to a countershaft, and then double belts to the main breaker, which runs at 100 r.p.m. This breaker will deal with 100 tons of stone per hour, at which rate subsequent operations are performed.

Two secondary breakers deal with the product from the main machine, further reducing the stone to 3 in. They are driven by the same motor which serves the main equipment. After its secondary breaking the stone is conveyed by a rubber belt and bucket elevators to screening plant. The drive for the belt conveyor is a 7½-h.p. Crompton Parkinson motor, 720 r.p.m., controlled by an Ellison air-break starter.

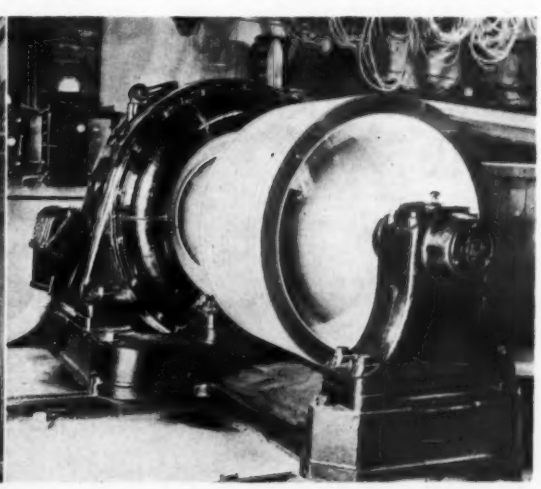
**Revolving dryer and its drive; top of mixer (in front of dryer) in line with bottom of the latter**

## Screening Plant

Rotary screens grade the stone into various standard sizes, rejects being returned to an auxiliary breaker driven by a 50-h.p. C.P. s.r. motor controlled by an Ellison oil-immersed circuit breaker and drum-type starter. In addition to the breaking plant there are four sets of rolls which reduce the larger sizes of stone from the screens to "smalls." The screens, rolls and bucket elevators are all driven by a 250-h.p., 2,000-V, 500-r.p.m. motor, served by an E. A. Co. oil circuit breaker and drum starter.



**Rear view of main breaker (swing jaw in motion); hopper above**



**A 250-h.p. motor driving the main and secondary breakers**

The graded stone is further belt conveyed to the tar-macadam bunkers, from which it is fed into four rotary driers and then passed on to mixers in which it is treated with the necessary quantity of tar before delivery direct from the inclined mixers into the company's railway trucks on an adjacent siding.

There are four complete mixing and drying units, each being driven separately by a 28-h.p. F. & A. Parkinson s.r. motor, 200 V, 940 r.p.m., governed by an Ellison oil c.b. and drum starter. There is also a tube mill which is fed with ¾-in. stone for reduction to dust for asphalt filling. This is driven by a 95-h.p., 200-V, 720-r.p.m. s.r. Metrovick motor, with similar oil circuit breaker and drum starter control.

Material up to 1¼-in. size is taken by two pulverisers for the production of a coarse-grade asphalt filler. These are each driven by a 100-h.p., 440-V, 720-r.p.m., s.r. Lancashire motor with oil circuit breaker and drum starter control. Auxiliary plant serving the pulverisers, elevators, fans, &c., involve a number of smaller drives totalling about 21 h.p.

## Electricity Supply Arrangements

Supply is received from the Derbyshire and Nottinghamshire Electric Power Co. at 11,000 V, three-phase. Some of it is taken over at this pressure directly by the consumer and transformed to 2,000 V and 200 V, two-phase, by a 500-kVA bank of Scott-connected transformers. The remainder is received at 440 V, three-phase, for serving the newer part of the mill. The two-phase supply is explained by the fact that the company, some six years ago, generated its own electricity by a two-phase alternator set.

The 2,000-V supply is distributed by a Metrovick four-panel cubicle switchboard, while a three-panel, flat-back J. & P. board serves for the 440-V distribution. On the 440-V system there is a three-core, l.c., d.w.a., 0.075-sq. in. cable suspended from catenary wires from the sub-station to the pulverising plant. Other cables are laid underground or bracketed round the walls to the various units, as is found to be the more convenient.

For power-factor correction on the two-phase system there are two condensers, one (185 kVA) serving the 2,000-V and the other the 200-V sections. The latter is a 600-V equipment to overcome size difficulties, and it is operated in conjunction with a 200/600-V, 100-kVA, step-up transformer. These condensers have improved the p.f. of the system from 0.7 to 0.95. On the 440-V side a 100-kVA condenser has resulted in improvement of the p.f. from 0.85 to 0.98. All the condensers were supplied by the Telegraph Condenser Co., Ltd.

# Industrial Electric Heating. By R. A. Thwaites, M.Inst.C.E., M.I.E.E.

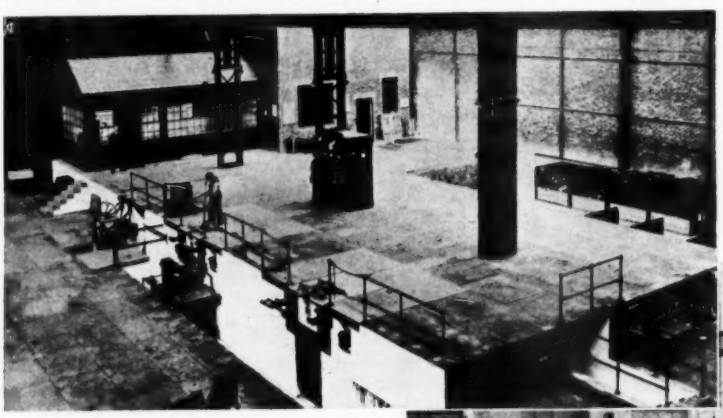
## An application that offers enormous scope

DURING the past few years manufacturers have begun to realise that for many industrial processes electricity is the ideal heating medium. It is clean, the temperature is readily controlled, there are no products of combustion to dispose of, it is efficient in use, and heat is produced just where it is wanted. The old arguments as to heat values have been worn threadbare, and it is now appreciated that what really matters are not merely the cost of fuel but the total cost of carrying out certain heating processes and the quality of the article produced.

To take an example: case-hardened automobile gears cost on the average between £250 and £500 per ton to produce, so that if the number of gears satisfactorily hardened is increased by only 1 per cent., this represents a saving of from £2 10s. to £5 per ton. In such cases it matters little whether the cost of providing heat amounts to a few shillings per ton more or less.

### Heat Treatment of Metals

In the carburising process the articles to be case-hardened are packed in compound in boxes heated to about 900 deg. C., and retained at this heat for some eight to ten hours. Once the boxes have attained this temperature, the only heat required is that necessary to compensate for the heat losses of the furnace. With an electric furnace this can readily be kept to a low figure. If a solid, liquid or gaseous fuel be employed, the products of combustion leave the furnace at a high temperature, and much heat is wasted.



High-frequency furnaces for alloy steels

Nitriding is a comparatively new case-hardening process. No quenching treatment is necessary, and distortion is thus completely avoided. The parts to be treated are made from a special alloy steel and are heated to, and maintained at, a temperature of approximately 500 deg. C. for about 50 to 100 hours while exposed to the action of ammonia gas. The reasons which justify the use of electric heating for carburising apply with even greater force to nitriding. Uniformity of heating and close temperature control are of great importance, and for this purpose electric furnaces are used exclusively.

In the annealing of metals the conditions are very similar to those prevailing with carburising, and electric heating is, in many cases, advantageous. Electricity is also being used to an ever-growing extent, both in the hardening and tempering of steel. One large engineering establishment in the north, specialising in the manufacture of gearing, completely converted its hardening shop to electric heating about a year ago, and the results have been in every way satisfactory. A group of electric carburising furnaces at these works is illustrated.

### Brass and Steel Melting

When there is a steady demand for molten brass, the induction furnace is particularly advantageous. The high frequencies employed at one time are no longer necessary, and commercial frequencies of the order of 50 cycles per second are now satisfactory. This has enabled the first cost to be reduced considerably and the efficiency to be increased. The temperature is under close control, and thorough mixing occurs as a result of the circulation caused by the induced current.

There is a saving in the cost of labour and furnace linings as compared with the older crucible process, and a superior quality of metal is produced at a lower cost. The size most commonly in use melts 5 cwt. per heat, and requires about 75 kW. Birmingham Corporation is already supplying some 4,000 kW for brass melting, and the load is steadily growing.

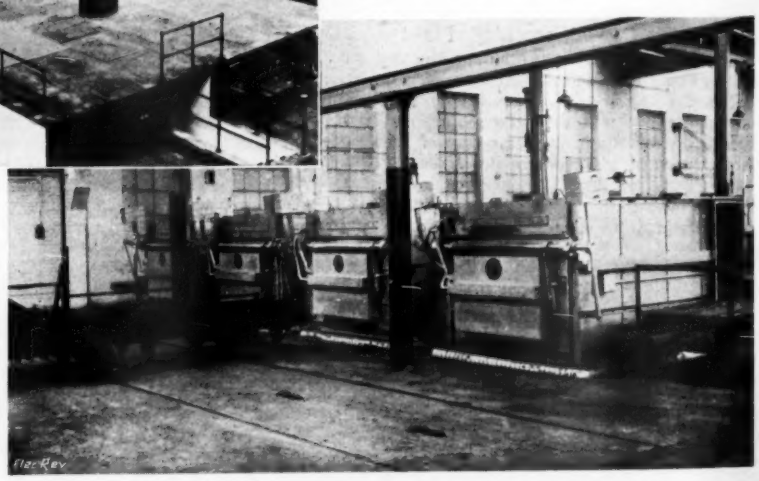
In the production of high-grade or alloy steels, the crucible process is steadily being superseded by the high-frequency induction furnace, for reasons which are similar to those which apply to brass-melting. In a steel-melting shop near Sheffield which has recently been put into commission the whole of the melting is carried out in the three Ajax-Northrup high-frequency furnaces illustrated.

Numerous arc furnaces are also in use in this country and elsewhere. Broadly speaking, the initial cost of a high-frequency furnace is higher, but the working costs are appreciably lower.

The full list of processes for which electric heating is satisfactory is a long one; of these, particular mention may be made of welding, rivet-heating, japanning, vitreous enamelling, and core-drying. Electricity has also been found invaluable for such small apparatus as solder pots, glue pots, soldering irons, and vulcanising apparatus.

There are certain applications of electric heating which, while not feasible in general cases, are advantageous in special circumstances. Among these may be included steam raising, which is practicable when small quantities of steam are required (particularly if intermittently), where space is limited, or where combustion is considered to be undesirable for any reason.

Another special case is glass-melting, and in Yorkshire a battery of ten small electric furnaces has recently been installed for melting glass as the first stage in a special process.



Electric carburising furnaces in a gear manufacturing works

There are some processes for which the use of electricity is at present unsuited. In these cases the only safe line to take is to be frank with the inquirer. To adopt any other course is to invite trouble, and to bring discredit upon the general application of electric heating.

### Cost of Electricity

The many advantages of electric heating are such that the supply undertaking usually has little difficulty in obtaining the load at economic prices. For small supplies 1d. per kWh is not unreasonable, and the price falls progressively to about 0.5d. per kWh where a large amount of energy is required, or even lower than this for guaranteed consumption during "off-peak" hours.

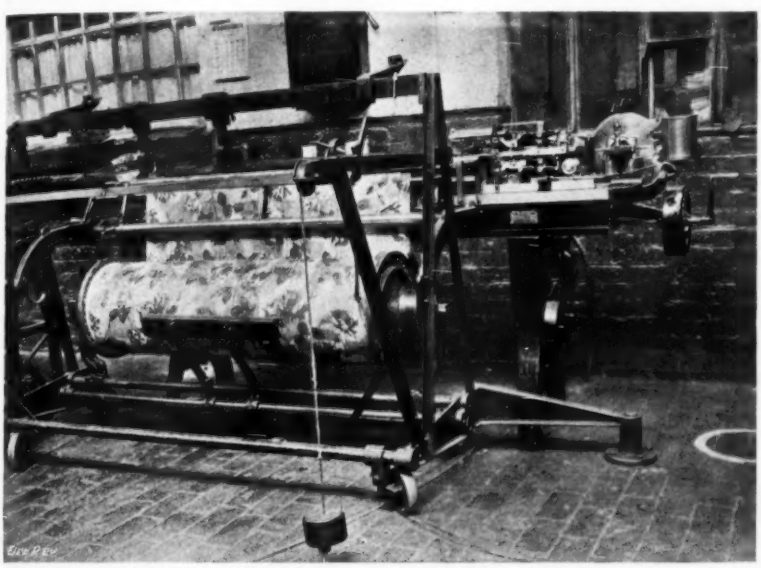
So far, only the very fringe of the potential industrial heating load has been touched. The position is very similar to that which existed in the early days of electric driving. Then the enterprise of a few convinced the many of the undoubted advantages of electricity for that purpose. So to-day the satisfactory application of electricity for industrial heating processes is becoming more widely appreciated. The design and construction of furnaces by manufacturers of repute are to-day perfectly satisfactory. The price of energy in most areas is sufficiently low to attract business. It therefore remains for the supply industry and the manufacturers of heating appliances to present the case convincingly to the industrialist if electric heating business is to be secured.

# Textile Mill Applications

## Electrically-driven weaving shed machinery

THE textile works at Swinton, Manchester, of Messrs. Simpson & Godlee, Ltd., include a large preparation building in which such operations as winding, beaming, taping and sizing account for about 50 h.p., but the principal operations of the company are carried out in the weaving sheds, where there are excellent examples of individual, group and "central" driving.

The essential operation common to all weaving is the building up of material by the interlacing of the weft (cross yarn) from the "cop," and the warp (lengthwise yarns) from the "beam." A plain loom does this only; a dobby loom is similar, but weaves striped material, and so on; a Jacquard loom weaves patterns in cloth, &c.



A warp-tying machine

### The Power Required by the Looms

A loom for up to 44-in. width of material requires ¾ h.p. to drive it; a 58-in. loom requires ¾ h.p.; and for a 67- to 74-in. loom, 1 h.p. is necessary. These figures are general and depend on other things, including the speed of operation of the looms. On decorated material a narrow loom will operate at from 160 to 200 "picks" (weft introductions) per minute, and a broad loom at from 130 to 165 picks per minute.

In No. 1 shed there are one 35-, four 30-, two 15-, and one 10-h.p. motors for driving 400 looms. The motors are suspended from the roof girders and chain drive the original layshafts served from the beam engine. They are controlled from a central point by, *inter alia*, Erskine Heap rotor-type starters.

A 125-h.p. motor drives the whole of the 240 looms in No. 2 shed. Two 5-in. Renold chains drive on to the original line shaft served by the beam engine, which, in turn, drives through bevel gears eight layshafts. The motor is a slip-ring machine with short-circuiting equipment, and is controlled by an oil-immersed switch with an Allen West liquid starter.

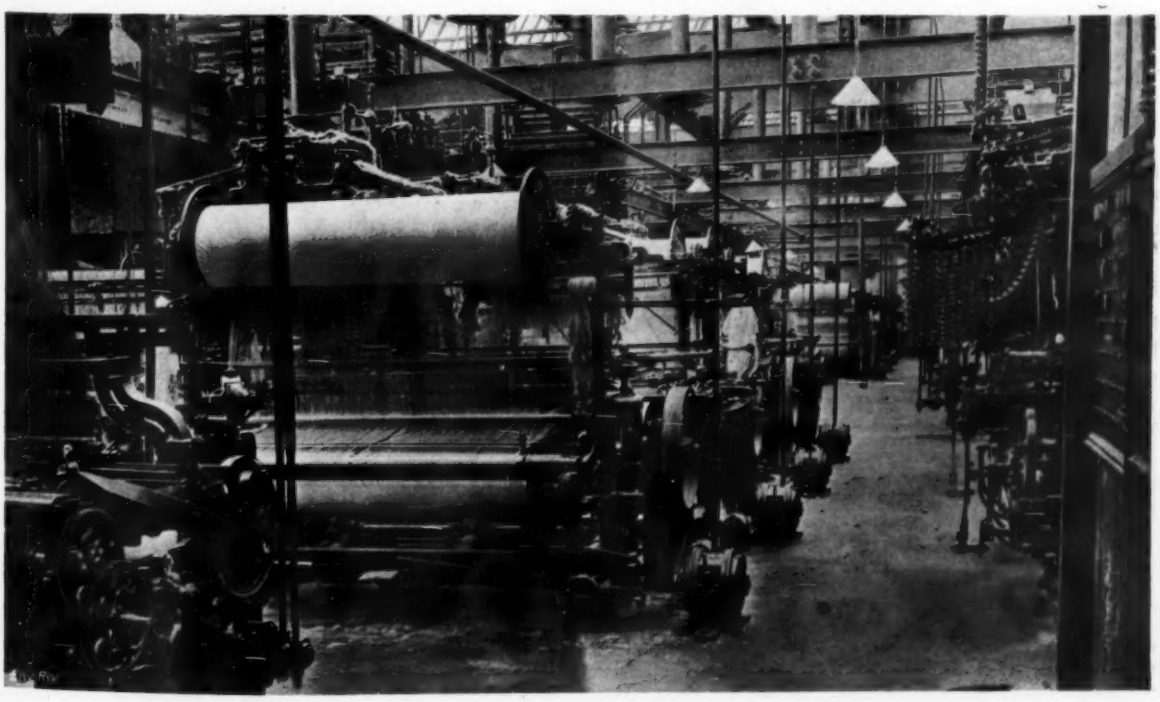
There are 166 looms in No. 3 shed, all with individual motor drives of up to 1 h.p., according to the type and size of the loom. Most of these have belt drives, but some operate through chains, and a few by gears. Each motor has direct-on switching, operating in conjunction with the loom handle. All the large motors are of B.T.-H. manufacture, and among the smaller ones were seen B.T.-H., Met.-Vick., G.E.C., and English Electric machines.

With the necessary data available, comparisons between the three driving methods would be of particular interest and value to the engineering industry generally.

### A Comparison of Systems

The individual drives in No. 3 shed were put in in 1916. The next move was to install three of the group drives in No. 1 shed, and this was followed by the complete electrification of this unit. Finally, in 1922 a 125-h.p. motor was installed as the central drive from No. 2 shed. The works engineer told us that generally the running of the machines served by the largest motor was steadier than that of the looms on group drives, and that there were fewer breakages on those individually driven machines with belt drives than on the chain-and-gear-driven ones, presumably owing to the slip afforded by the belts.

A very interesting "built-in" electrically driven equipment seen in this factory is a warp-tying machine, with a ¼-h.p. motor. This machine will join together the ends of two yarn beams with 5,000 threads each, tying a separate knot in each pair of threads, in less than half an hour. By hand this operation would take over four hours.



Individually driven looms in one of Messrs. Simpson & Godlee's weaving sheds

# A Yarn-dyeing Works

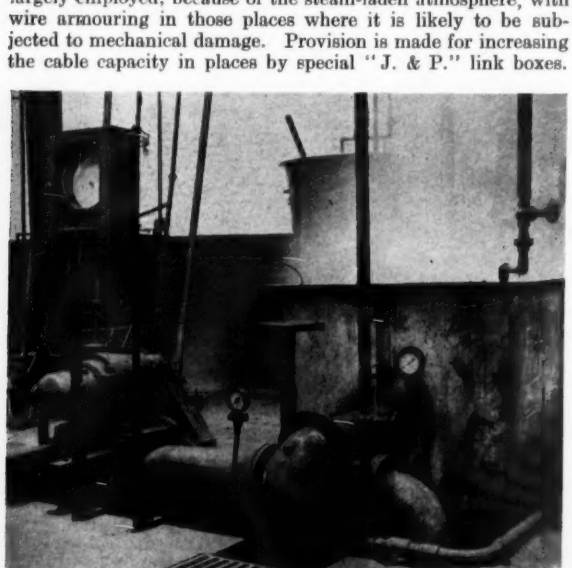
UPON a recent visit to the yarn-dyeing works of Messrs. R. P. Lawson & Sons, Ltd., Manchester, we found a completely new electrical installation, for the company took advantage of the opportunity to modernise its equipment in connection with the change-over scheme (d.c. to a.c.) of the Manchester Corporation electricity undertaking.

Main l.p. circuit breakers in the sub-station serve two sectionalising switching stations, and these govern main distribution boards A to J, which in turn serve sub-distribution boards, switches, etc., throughout the factory. Every main and sub- "dis" board and every motor switch is numbered. For example, F 2/3 indicates the third motor off the second sub-distribution board supplied from the main board F. Ellison

**Double lines of winding spindles (2-h.p. motors, push-button control)**

pedestal circuit breakers are employed. Messrs. Geo. H. Scholes were responsible for the installation work.

"Semaphite" cable, with asbestos-bitumen covering, is largely employed, because of the steam-laden atmosphere, with wire armouring in those places where it is likely to be subjected to mechanical damage. Provision is made for increasing the cable capacity in places by special "J. & P." link boxes.



**Dye tank, showing motor-driven circulating pump**

A second cable can be installed in parallel with the original one. Practically all the machines are now individually driven.

In the dye tanks the liquids are circulated several times a minute, and for this purpose pipe-ventilated motors, of from 2 to 15 h.p., drive circulating pumps. Several electric cranes are installed for lifting the materials from the dye tanks. Wet yarn is put into Broadbent centrifuges for partial drying, and generally a 20-h.p. motor, 700 r.p.m., in each case is integral with the rotating member.

## Drying Methods

Final drying of the dyed yarn is carried out in tower-type stoves through which steam-heated air is circulated by a 7½-h.p. motor-driven fan. A 5-h.p. motor drives the lifting gear employed in conjunction with each of the stoves. A distance thermometer is installed at about the middle of each stove chimney, and each pair is served by a Cambridge thermograph for indication purposes.

Much is done in yarn winding both before and after dyeing, and many lines of spindles may be seen, each driven by a 2-h.p. motor. Some of the motors drive through gearing and are controlled by Igranic push-button switches, while others have chain drives and are governed by "change-over" starter switches. The drives have speed reductions of from 2,400 r.p.m. (motor) to 800 r.p.m. (spindle). For heavier work there are some 7½-h.p. motors driving lines of spindles. These also have star-delta starter switches.

A 7½-h.p. motor drives two mercerising machines. Some of the winding motors were supplied by Higgs Motors. An interesting feature is a number of particularly neat cranes for delivery from the upper floors. Each is equipped with a 5-h.p. a.c. motor.

## Air Conditioning

To prevent precipitation from the roofs, etc., a fairly high temperature has to be maintained, and this is effected by driving air over banks of steam coils. There are six heating points, one served by a 7½- and five by a 5-h.p. motor each. The largest motor drives a 60-in. fan, which will deliver from 23,000 to 50,000 cu. ft. per min., and the other fans are 36 in. diameter each, with a capacity of from 9,000 to 16,000 cu. ft. per min. There are also three motor-driven exhaust fans.

For determining the moisture content of yarn, there is an electric conditioning oven, which was made on site. The outer casing is a cylinder (vertical), and a 500-W "Chromalox" element with three-heat control is fixed to each of three plates, arranged one above the other and separated by a few inches. Holes are arranged in the plates in baffle formation to circulate the air from the open bottom to the container above the plates. Suspended in the container, a cage holder for the yarn forms one pan of a pair of scales arranged externally. In the laboratory we saw a "home-made" rectangular water heater, fitted with a 1,000-W "Chromalox" immersion heater.

The Hodgkinson sprinkler stokers of two Lancashire boilers are driven by a 5-h.p. motor, and a 20-h.p. a.c. variable-speed motor drives an induced-draught fan. This motor was supplied by Laurence, Scott & Electromotors, Ltd., and is controlled by an Ellison oil circuit breaker and a face-plate starter. A number of "daylight" colour-matching lamps was seen.

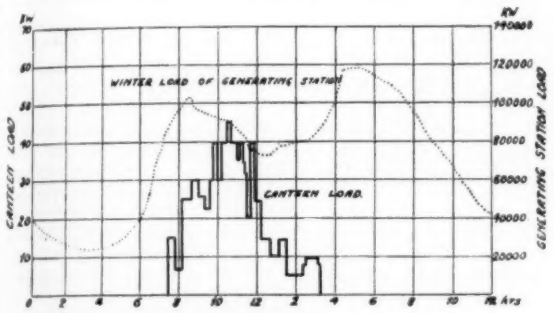
Mr. H. Stevenson, works manager, said that the company had definitely experienced a saving in maintenance costs since the change over to a.c.

# The Factory Canteen. By T. Settle, Ph.D., M.I.E.E.

## Cooking provides the most important application of electricity in this department

ELECTRIC cooking on a large scale has made more headway in factory canteens than elsewhere, and by far the larger proportion of heavy-duty installations are in service in such establishments.

There are several reasons for this. The decision as to the use of electricity in this kind of establishment is usually left not to the chef or kitchen staff, as it very often is in restaurants and hotels, but to the engineering staff and the management. In most works canteens the cooks are women, who are not so much guided by old-fashioned ideas as is the average chef. Meals are far simpler and are not left so much to the discretion of those who eat them. It is obviously easier to prepare stereotyped meals than to cater for varied demands.




**Canteen and supply undertaking's load curves**

Very often the supply of electricity in works is taken in bulk for power purposes, and a few thousand kWh more or less for cooking does not materially affect its total cost.

### Cooking and the Station Peak

Unfortunately, in this country no details are available of the relation of the cooking load of a works canteen to the central station load, but careful investigations instituted in Germany have shown that the maximum demand for canteens is usually about two hours before meal times. The first illustration* shows that the load of a German works canteen catering for 300 people comes practically within the valley of the central station load.

Many of the general advantages of electric cooking apply particularly to factory canteens. It has been found by experience that in re-decoration alone considerable amounts can be saved as compared with kitchens in which fuel-fired or gas-fired appliances have been installed. Electric cooking lends itself more than any other method to rigid economy. The consumption of energy can be very closely controlled, a considerable saving in shrinkage of meat can be realised, and the necessity of working for a few hours daily under high pressure makes it obligatory to create the best possible conditions for the kitchen staff.

Maintenance costs in these canteens are extremely low. There are figures available for the two canteens referred to below which show that the maintenance, *i.e.*, replacement of elements, hotplates, &c., need not exceed, for an installation of that size, £5 or £6 per annum. The layout of a canteen kitchen is of great importance, as the largest possible number of consumers must be served in the shortest possible time. Labour saving is also an important item, as the kitchen and serving staff is only employed for a comparatively short time.

### Modern Installations

The second illustration, showing the layout of a large installation in London, may be considered as ideal as regards the supply and handling of raw materials and the preparing and serving of the cooked food. The workpeople enter at A, pass in front of the pay-box, and by the hotcupboards at B containing ready carved or dished-up portions, which are kept warm when the rush of people comes along during the meal hour. They then pass into the dining room in the direction of the arrow. The equipment of this particular kitchen consists of: A large cabinet roasting oven, 12 kW; a large double oven range, 30 kW; three boilers, 6 kW each; two milk and coffee boilers, 2.4 kW each; a 3-pan fish fryer, 21 kW; an electric steamer, 7 kW; an electric boiling table, 21 kW; and four hotcupboards with a total loading of 10.5 kW. There are also a steamer, a carving table and hotcupboard, both steam-heated. The hotcupboards can also be used for warming up food brought by the workpeople.

The total loading is approximately 135 kW. There is an average daily service of 800 luncheons and a number of teas. The consumption is 335 kWh per day, which works out, ignoring the teas and the additional steam equipment, at about 0.4 kWh per meal. This figure may be taken as an average for factory canteens.

In a large canteen in the Midlands, where a maximum of 350 people are catered for in the winter (fewer during the summer), the total consumption in 1931 was 30,000 kWh. Taking 300 working days, this means an average of 100 kWh per day, which is approximately again 0.4 to 0.5 kWh per meal. In a large American industrial cooking installation† 1,000 meals are served per day for five days per week—an average of 20,000 per month. The total connected load is 213 kW and the consumption is about 11,000 kWh per month, or approximately 0.5 kWh per meal.

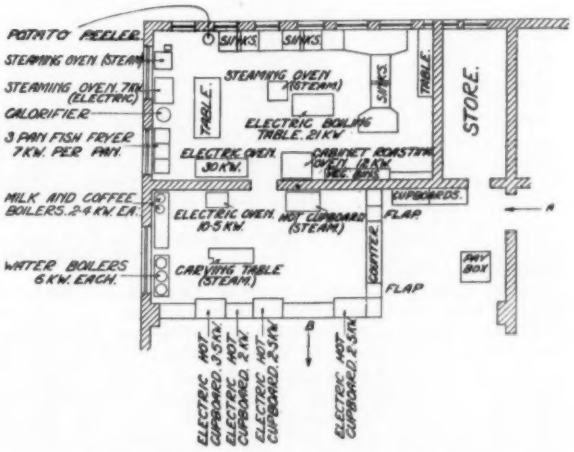
### The Economic Question

Part of the gas equipment in an important installation in the Midlands was replaced by electrical equipment. Roasting, grilling, and fish frying is done electrically, whilst for boiling, steaming, &c., gas is still being used. For six months weekly records were taken. The total consumption of electricity for the period was 13,129 kWh. In the corresponding period of the previous year, when gas was exclusively used, the total consumption was 452,300 cu. ft. The consumption of gas for boiling, &c., during the recent period was 99,300 cu. ft., so that 353,000 cu. ft. of gas had been replaced by 13,129 kWh.

At 1d. per kWh the cost of electricity amounted to approximately £54. At 3s. 6d. per 1,000 cu. ft., the cost of gas was £62. These figures prove that the usual comparison between 1d. per kWh and 8d. per therm is correct. There is no doubt that, even if boiling also was done electrically, the basis of comparison would not have to be altered. At ¾d. per unit, of course, the saving due to electricity would be beyond question.

**Dr. Settle is in charge of the Industrial Electric Heating Department of the C.E.C.**

When offering electrical equipment for works canteens a number of points must be borne in mind, such as the available space, the type and class of workpeople, the nature of the meals, &c. It has to be considered whether the number of workpeople is constant or varying, and whether feeding in the canteen is compulsory (by circumstances) or voluntary. In the latter case the meals and prices must be as attractive as possible.




**The arrangement of a modern canteen**

Workpeople who have well-cooked meals in satisfactory surroundings are the best propagandists for the increased use of electricity in their homes and elsewhere.

* Elektrizitatswirtschaft, Mitteilungen der VDEW. No. 499.

† Commercial Cooking and Baking Sales Manual of the N.E.L.A. Page 55.

# The Electro-chemical Industry. By S. Wernick, M.Sc.

## Its scope and general tendencies

THE products which are directly or indirectly made by electro-chemical means range from the important industrial metals, (*e.g.*, iron, steel, brass, copper, nickel, lead, zinc, aluminium, and tin), abrasives, refractories, solvents, lubricants, paints, to automatic lighters, insecticides, fertilisers, artificial silk, and even matches!

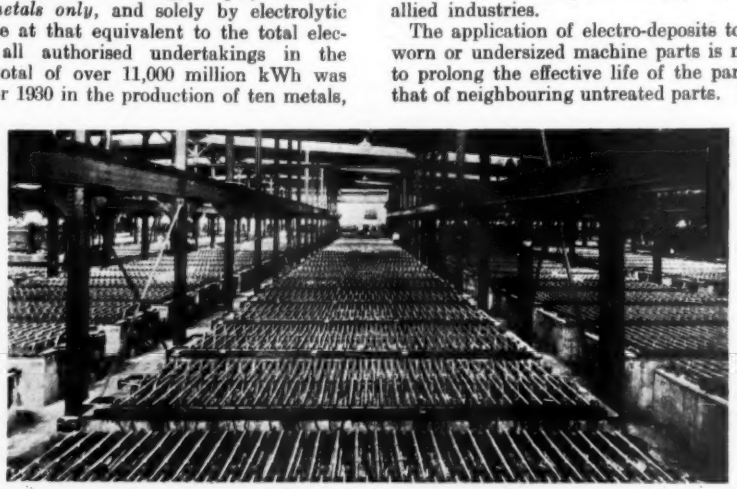
The term "electro-chemical" does not merely cover the use of electric current to effect a chemical change, which is fundamentally the basis of electrolytic work, or the use of chemical means to produce an electric current as exemplified by the common primary battery. It also includes the change of electrical into chemical energy through an intermediate form of energy, heat; under this, the electrothermal, group is included the production of such important chemicals as calcium carbide, graphite, cyanamide and the synthetic abrasives. Another big group is concerned with the production of substances which can only be obtained at the high temperatures achieved in the electric furnace; some of the most important of these substances are the ferro alloys—ferro-manganese, ferro-chromium, ferro-tungsten, &c.—used in the production of special steels possessing toughness, hardness and corrosion-resisting properties; they are important, too, in the production of high speed tools, armour plate, projectiles, &c.

**Mr. S. Wernick, hon. secretary of the Electroplaters' and Depositors' Technical Society, is a specialist in corrosion prevention by electro-deposition**

### The Electrolytic Field

The electrolytic applications probably present the most fascinating field in the whole realm of electro-chemistry. They may be conventionally sub-divided under the following heads: (1) electro-refining; (2) electro-winning; (3) electro-plating and electro-forming; (4) electrolysis of fused salts and (5) electrolytic caustic and chlorine production.

A recent estimate of the electrical energy employed in the world for producing *metals only*, and solely by electrolytic means, places the figure at that equivalent to the total electricity generated by all authorised undertakings in the United Kingdom. A total of over 11,000 million kWh was consumed during 1929 or 1930 in the production of ten metals, the principal being copper (refined) (1,500,000 tons per annum), 485 million kWh; copper (from leached ores (200,000 tons), 400 millions; zinc (390,000 tons), 1,800 millions; aluminium (267,000 tons), 8,000 millions; and lead (220,000 tons), 30 millions.



**The cell room of the Port Colborne electrolytic nickel refinery of the International Nickel Co. of Canada, Ltd.**

Electrolysis as a means of producing metals is only possible when carried out on an economic basis in direct competition with purely chemical methods. This is possible usually as a result of the more simplified procedure which characterises electrolytic methods, and also the very high purity of the products; while, further, the eventual extraction of valuable by-products is often of the utmost importance in reducing the working costs of a given electrolytic process. The highly pure copper so essential to the electrical industry is, of course, electrolytic, and so big is the demand for this grade of copper that very little copper is produced in any other way.

### Recovery of Precious Metals

The precious metals with which copper is associated in its ores are usually so small in concentration that it would be impossible to recover them by any other than the electrolytic method, but they are so lucrative a by-product that a very large quantity is recovered annually. For example, considerably more than half of the world's production of silver is produced as a by-product in the refining of copper and lead.

Concentration on the production of precious metals is a very recent development in this country. The resources within the British Empire compare very favourably with those of any other part of the globe, and the last year or two has seen very considerable expansion in the production of platinum, palladium, rhodium, ruthenium and osmium by the Acton Precious Metals Refinery, a part of the Mond Nickel Company. The raw material treated at this refinery consists mainly of the "concentrates" (largely the anode sludge formed in the electrolytic refining of nickel) obtained from the International Nickel Company's refinery—one of the largest in the world—situated at Port Colbourne, Ontario.

While the silver and gold present in the concentrates are refined by electrolytic means, the platinum metals mentioned above are nevertheless most economically obtained by chemical methods. The enormous total output of 91,644 oz. was achieved in 1931, of which 44,725 oz. was platinum.

The refining process entails the separation of seven distinct metals from each other, and from their accompanying base metals, yet not more than ½ per cent. of the platinum metals contained in the concentrates is lost, while 2½ per cent. which is retained in the furnace slags is returned to the nickel refinery for retreatment. The cost of refining depends largely on the scale of operations; at present the cost of refining platinum metals is about 10s. per oz., and does not add appreciably to the cost of producing nickel and copper.

### Electro-plating and Electro-forming

The primary application of electroplating is still as a decorative and protective coating for metals which are less pleasing in appearance or more corrodible than the base metal-deposit ensemble. Metals which are commonly deposited to-day include copper, nickel, zinc, tin, silver, gold, chromium, and cadmium, and, latterly, the precious metals, palladium and platinum. The "stainless deposit," chromium—an innovation but four or five years ago—is ubiquitous to-day. Cadmium, another of the "newer" metals, from the depositor's point of view, is being increasingly utilised as one of the most effective protective coatings of ferrous materials known.

Platinum and palladium deposition, while not so popular as chromium, are being increasingly applied in the jewellery and allied industries.

The application of electro-deposits to the "building up" of worn or undersized machine parts is now commonly practised to prolong the effective life of the part treated—often beyond that of neighbouring untreated parts. The metals most usually employed for this purpose are nickel and chromium.

Perfect deposits can be produced, ranging from minute thicknesses to those requiring days of continuous deposition and amounting to ¼ in. or more in thickness. At one end of the scale we have transparent gold films (some of these were recently exhibited at the Faraday Centenary exhibition) not more than from 0.00002 to 0.00005 mm. in thickness, and at the other end of the scale the rebuilding of shaftings, parts of commutators, motor vehicles, etc., several tenths of an inch in thickness.

The newer plating technique resulting from intense research work during recent years is responsible for the improved nature of deposits. Mass-production methods have been introduced and the whole cycle of operations in the production of good quality electro-plate are carried out automatically.

The numerous applications of electro-forming—the production of electrotypes for many different purposes, the manufacture of gramophone records from electro-deposited matrices, the plating of non-metallic articles of utility and luxury and the reproduction of all manner of things by galvanoplasty—are all products of thriving industries. It would be difficult indeed to estimate the amount of capital sunk in these various industries, but it assuredly amounts to many millions.

# The Scope for Development Yet. By V. W. Dale

## Electrical prospects in some of the new industries

RECENTLY published statistics regarding the quantity of electricity used in various trades and industries in this country are at the same time surprising and stimulating—surprising because they reveal that an extraordinary amount of electricity is still generated at the works of private firms, and stimulating by virtue of their indication of an immense amount of valuable load which is waiting on the doorstep of public suppliers.

**Mr. V. W. Dale, who is Business Manager of the British Electrical Development Association, indicates a bright future for the electrical industry**

The table below has been prepared from preliminary and provisional data contained in periodical reports on the Fourth Census of Production; the figures relate to complete calendar or business years, but the information which was obtained under compulsory powers in 1930 as to the total quantity of electricity used, distinguishing electricity generated in firms' own works from electricity purchased, was furnished voluntarily and incompletely in the Census of 1924. The figures presented indicated clearly a demand for immediate and intense effort by the supply industry.

The list is incomplete but the very important point emerges that these trades and industries alone account for well over 2,000 million kWh per annum, not at present purchased from public supply undertakings.

### New Industries

Legislation commencing with the Safeguarding Act or earlier enactments and culminating with the tariffs must have the ultimate effect of rapidly increasing the demand for electrical energy to meet the requirements of extending existing industries and of new industries which are being established here. Unfortunately, in any investigation it is necessary to depend to a considerable extent upon hypotheses since the distinction between electricity derived from public and private sources was obligatory for the first time in the 1930 Census. At the same time official reticence in publishing comprehensive details of new industries limits the vision of the investigator. Local investigation, however, should be quite practicable and of great value.

A recent announcement by Mr. Hore Belisha throws some light on the subject. In a period of approximately three or four weeks fifty-seven new factories were established in the country, thirty-eight of which were in the Greater London area, eight in Lancashire, Cheshire and Yorkshire, nine in the Midlands, and two in other areas; the industries mainly affected included furnishing, fabrics, ribbons, hosiery, knitting, leather and toilet products, and various metal and electrical trades. A still later report in the press indicated that nearly one hundred new enterprises had been established here in the last few months, most of them coming from the United States, Germany, Holland, Switzerland, Belgium, Austria, Czecho-Slovakia, and Denmark. Several British firms have also begun to manufacture commodities which they formerly imported.

### Extending the Power Load

On the manufacturing side of our own industry, for example, it is anticipated that at a new factory, which is being established at Rugby for the manufacture of refrigerators, work will be provided for 6,000 employés while large numbers of workers in the steel and tool trades will be beneficially affected. It is further reported that in this one organisation alone additional energy will be required to the extent of one million kWh per annum. In the radio industry at least two well-known manufacturers are taking steps to double their existing plant and output.

The object of this brief statement, which merely touches the fringe of a vitally important investigation, is to indicate the necessity for exploring every avenue for the extension of the power load. It is clear that the industry, without relaxing in the slightest degree the sustained effort of the last few years in developing the domestic side of the supply business, must not overlook the fact that electricity is a universal servant and that whenever and wherever energy is required for any purpose it is the lawful prey of the public supply undertakings. The position revealed by the Census, particularly with regard to the employment of other forms of power which have not been dealt with in this statement, must be intolerable to electricity supply undertakings in industrial areas and it is pretty obvious that a sales force is every bit as necessary for the disposal of large quantities of electricity as for the small. Certainly it would appear an urgent preliminary for every undertaking to take immediate steps to carry out a thorough survey of every industrial organisation within its area.

TABLE SHOWING PROGRESS OF INDUSTRIAL ELECTRIFICATION during the period 1924–1930 and comparative data regarding electricity purchased from supply undertakings and electricity generated at the works of industrial organisations.

| Nature of trade. | 1930. Million kWh. Generated at firms' works. | 1930. Million kWh. Purchased. | Percentage of total capacity of generators in use in the trade. | 1924. Million kWh. Percentage of electric motors (in use) in the trade driven by purchased electricity. | 1924. Million kWh. Generated at firms' works. | 1924. Million kWh. Purchased. |
|---|---|---|---|---|---|---|
| *Steel smelting and rolling mills | 601.3 | 280.2 | *71.0* | *80.7* | 305.3 | 221.8 |
| *Tinplate | 34.8 | 15.9 | *74.4* | *98.1* | 17.2 | 8.3 |
| *Wrought iron and steel tube | 4.7 | 67.5 | *99.4* | *87.1* | 8.8 | 31.3 |
| Wire trades | 17.6 | 44.0 | *66.9* | *87.0* | 12.0 | 38.6 |
| Cotton | 21.4 | 50.9 | *34.4* | *69.0* | 40.2 | 134.3 |
| Paper | 574.1 | 90.8 | *50.0* | *56.0* | 108.8 | 35.5 |
| Wallpaper | 2.2 | 1.9 | No useful comparison available. | | | |
| **Copper and brass (smelting, rolling and foundry) | 16.9 | 50.5 | *65.8* | *69.3* | 173.1 | 44.8 |
| Lead, zinc, iron and aluminium | 65.4 | 110.4 | No comparison | | | |
| Iron and steel foundries | 35.3 | 65.1 | — | — | — | — |
| **Motor and cycle | 26.4 | 168.8 | *34.8* | *62.6* | 12.4 | 85.4 |
| Aircraft | 1.3 | 13.3 | — | — | — | — |
| Railway carriage and wagon | 18.7 | 24.3 | *88.8* | *72.4* | 10.0 | 19.4 |
| †Hosiery | 5.0 | 21.8 | *39.6* | *32.5* | 1.6 | 3.8 |
| **Rubber | 23.7 | 142.9 | *97.8* | *86.8* | 49.7 | 27.8 |
| **Grain milling | 17.3 | 107.5 | *48.7* | *60.9* | 18.4 | 59.8 |
| **Seed crushing | 20.8 | 34.1 | *84.4* | *85.4* | 10.9 | 21.5 |
| Oil and tallow | 13.5 | 5.9 | *75.3* | *51.5* | 13.7 | 1.8 |
| Matches | 2.2 | 0.2 | *87.6* | *57.3* | 2.3 | 0.3 |
| Electrical engineering | 19.1 | 185.1 | *68.4* | *64.4* | 38.1 | 67.1 |
| Tools and implements | 1.2 | 23.8 | *40.4* | *52.5* | 0.9 | 14.7 |
| China and earthenware | 4.0 | 17.9 | *40.6* | *54.8* | 7.8 | 5.6 |
| Linoleum and oil-cloth | 23.6 | 8.1 | *22.4* | *79.9* | 3.7 | 4.3 |
| Chemical dyes and drugs | 355.5 | 259.9 | *66.8* | *82.0* | 109.5 | 129.9 |
| Fertiliser, disinfectant and glue | 4.9 | 15.4 | *40.2* | *72.5* | 1.6 | 7.3 |
| †Explosives and fireworks | 13.0 | 2.0 | *73.2* | *89.2* | 6.9 | 1.0 |
| Petroleum refining | 42.5 | 2.4 | — | — | — | — |
| Cement | 110.4 | 282.5 | *53.8* | *69.6* | 118.9 | 31.0 |
| Silk and artificial silk | 62.1 | 132.4 | *87.6* | *80.7* | 40.0 | 26.7 |
| Lace | 1.2 | 3.2 | *5.6* | *43.4* | 0.1 | 1.3 |
| Butter, cheese, condensed milk, and margarine | 16.9 | 9.4 | *72.5* | *72.5* | 12.2 | 3.3 |
| †Tobacco | 2.0 | 14.3 | *98.7* | *95.2* | 1.4 | 8.4 |
| Rope, twine and hemp | 1.1 | 10.8 | *45.7* | *53.7* | 1.0 | 4.9 |
| Hemp and linen | 2.4 | 6.0 | — | — | — | — |
| Soap, candles and perfume | 21.4 | 8.6 | *26.4* | *84.2* | 2.8 | 5.8 |
| Cocoa and sugar confectionery | 13.1 | 59.9 | *74.6* | *66.4* | 11.8 | 27.7 |
| Glass | 67.8 | 67.9 | — | — | — | — |
| †Brick and fireclay | 31.7 | 65.8 | *13.1* | *54.4* | 2.2 | 14.8 |
| Jute | 8.1 | 14.4 | — | — | — | — |
| Starch and polish | 1.7 | 5.7 | — | — | — | — |
| Ink, gum and sealing wax | 0.3 | 4.1 | *98.2* | *58.3* | 0.1 | 2.1 |
| Preserved foods | 0.2 | 9.1 | *14.1* | *72.8* | 0.2 | 6.2 |
| Anchor, chain, nail, screw, etc. | 3.1 | 51.2 | *81.6* | *49.5* | 4.1 | 11.1 |
| Scientific instrument and cinema film | 2.8 | 10.5 | *57.4* | *73.8* | 1.6 | 6.5 |
| Umbrella and w.stick | 0.88 | 0.952 | *74.6* | *89.5* | 0.28 | 0.944 |

* Substantial increases in the amount of electricity used. † Increases in amount of electricity used. ** Increases in purchased electricity.
Where no indication is given the data are insufficient to determine a close comparison.

# Electric Heating Elements. By C. H. Archer

PROGRESS in electric heating virtually dates from the introduction of nickel-chrome alloys. I believe I was the first user in this country of the nickel-chrome resistances introduced from the United States, after having worked in collaboration with the originators of the alloy. The first alloy was nickel-chrome iron, in proportions of roughly 65, 15, and 20 per cent., respectively. Its specific resistance was considerably higher than that of any previously known resistors; the greater cross-section gave robustness; and current density was increased three- or four-fold.

This material was first used in the construction of open coil wire-wound radiator elements. Prior to this such elements were run only at a black heat, not exceeding 450 deg. C. so as to prevent free atmospheric oxidation. To-day fire elements are in common service at 1,000 deg. C., but although they are fairly reliable it is to be hoped that some new fundamental material will be evolved to give very much better service.

What is required is a resistor material that will have: (a) a resistance about double that of nickel-chrome, which averages about 650 ohms per circular mil foot, or 108 microhms per cu. cm.; (b) complete resistance to oxidisation at temperatures up to 1,100 deg. C.; and (c) a high tensile strength at high temperature. The temperature co-efficient is not of great importance.

### Effects of Temperature

Research has conclusively proved that the presence of alkalis in the supporting media for nickel-chrome resistors is definitely detrimental, and that the virtue of nickel-chrome is due to the film of oxide formed on its outer surface at a high temperature, which is its main protection against further oxidisation. This has been proved by gradually increasing the current density in a robust nickel-chrome wire, supported throughout its length, until its core has become molten (at about 1,700 deg. C.); the core has then been poured out, leaving a tube of nickel-chrome oxide.

It is fairly simple to design apparatus for temperatures up to 500 deg. C., but above that up to 1,100 deg. C. the difficulty is progressively increased. One of the greatest problems is still the provision of a really satisfactory electric boiling plate. There is a preference by the user, on " psychological grounds," for the open coil boiling plate, which once had a considerable vogue. It is still greatly in evidence in the U.S.A. because of the lower supply voltages, but in this country it was found too costly in maintenance, as it was subject to all kinds of abuse and increased the risk of shock.

It has become almost universal practice in Britain to provide enclosed boiling plates in which temperature-resisting metal receives heat units from the resistor, by conduction or radiation, and transfers them by conduction to the bottom of the vessel to be heated.

### Resistance Materials

Resistors other than nickel-chrome are made of:—

(1) Silicon-carbide, a product of the electric arc furnace; this is made in circular or rectangular rods, but in practice it has been found troublesome on account of its extremely brittle nature, difficulty in making permanent terminal contacts, and a gradual increase in resistance when it is in use.

(2) Graphite-carbon mixtures or bonds generally produced in the form of rods; troubles eventually occur as in (1) but more so.

(3) Granular metallic and carbon substances compressed into refractory tubes or slabs; these have special applications only.

The reliability and efficiency of the electrical element depends entirely upon the proper application of the resistor to the device to be heated; this is by far the most important detail of the whole electric heating scheme. A resistor used in the open air carrying a current producing, say, 900 deg. C. when applied to a heating device would reach a temperature of, say, 300 deg. C., the difference being accounted for by the heat conduction between the resistor and the contact surface.

### Types of Elements

Electric heating elements can be classified as: (1) totally enclosed; (2) mechanically supported on refractory supports; (3) mica-wound conduction elements; and (4) mechanically supported resistors.

The simplest form of element is a mica former of a required shape, around which is coiled nickel-chrome resistance ribbon or wire of the necessary length and resistance to give the heat emission required, with the ends of the resistor terminating in nickel flexible clips. This is the method commonly used for electric irons and practically all domestic appliances for table use.

The electric fire element in general use is a nickel-chrome resistor almost always made in the form of a helix either mechanically supported in refractory bases or wound round refractory tubes or rods. The resistors are designed to attain an average temperature of about 900 deg. C., at which their life is satisfactory.

Embedded nickel-chrome resistors in principle consist of a heat-resisting metallic housing and suitable refractory cement (the subject of extensive research for very many years) which electrically insulates the resistor and allows satisfactory thermal conductivity.

As these two conditions are diametrically opposed, the problem is a difficult one. Virtually all known electrical insulators can be made conductive if their temperature is raised sufficiently. This also is one of the chief difficulties with refractories, but British-made cement-filled boiling plates are in commercial production to-day, giving better service than any foreign-made plates of a similar kind ever did.

### Sheathed Patterns

A form of embedded resistor element is a nickel-chrome helix encased in a metal tube, termed the " sheathed " element. For high temperatures a heat-resisting metallic tube, and for medium temperatures (for immersion in liquids) a copper tube are used. This type of element allows satisfactory heat transference from the resistor to the outside of the tube, while giving a satisfactory electrical insulation. Another form of " sheathed " element is the " disc " type, which is virtually a heat-resisting metallic trough filled with refractory material in which the nickel-chrome resistor is embedded, the whole being sealed up mechanically.

The heavy nickel-chrome rod resistor working with current supplied at a very low potential (2 to 10 V from the secondary of a step-down transformer) has given satisfactory performance but entails a serious additional cost.

Modern domestic electric cookers, which are being installed in Great Britain at the rate of 50,000 per annum, can be confidently regarded as a practical success, but there is always room for continuous improvement; attempts have been made at standardisation, but this has proved impracticable at the present stage. One almost unsurmountable difficulty in this direction is the attitude of the supply engineer, who, generally speaking, requires his own particular features embodied in the design and application of the cooker; " fashion " also is a very live element in the domestic field.

# The Scottish Electrical Contractors' Conference

MEMBERS of the Electrical Contractors' Association of Scotland assembled at Taymouth Castle, Perthshire, on May 27th, for their third annual conference, and were received by the retiring president, Mr. Henry Meighan, and his wife.

On the Friday afternoon the annual meeting of the Association was held in the Castle Library, and there was a very representative gathering of members from all the four branches of the Association. The report of the Central Board, which was submitted, recorded steady progress, and the activities of the Association in trade negotiations were reported on and discussed in detail. Continued support for the " Fair Trading Policy " promulgated by Committee " D " was recorded and the Association's representatives on that committee were instructed to contend for a policy based on that committee's report and to oppose the withdrawal of concessions made by accredited representatives of the different sections on that committee. It was also reported that the general conditions under the Scottish Mode for building contracts had been revised, and that a sub-committee had been set up to revise the electrical rules under the Mode. A net addition of twelve members was reported, the total at April 30th being 272.

The following office bearers for the ensuing year were elected:—President, Mr. J. L. Anderson, Aberdeen; vice-president, Mr. David Bennett, of Haddow & Co., Ltd., Glasgow; secretary, Mr. Walter Finlay, Edinburgh.

At the conclusion of the meeting the retiring president, Mr. Henry Meighan, was presented with a gold replica of the presidential badge by the new president, Mr. J. L. Anderson.

On the Saturday afternoon the second session was held, the new president presiding. The first paper, entitled " A Stocktaking of Ideas," was by the new president, who discussed the lines on which progress might be accomplished and the many directions in which the up-to-date electrical contractor might push his business.

The second paper was by Mr. R. A. Ure (Glasgow), and was entitled, " Our Association and What It Stands For." Mr. Ure recorded the early history of the Association, and said that he believed it could claim to be the first trade Association formed in the electrical trade in Great Britain.

Before lunch on Saturday members played the annual golf match—East *versus* West—for the " Pratt Trophy." On this occasion the position of last year was reversed, and the East competitors won by the narrow margin of one match.

A whist drive was held on the Friday night, and dancing took place on both Friday and Saturday nights in the Banner Hall. The weather was excellent till the Sunday, when members were compelled to give up outside pursuits and amuse themselves indoors. Despite the bad weather, however, many took the opportunity of motoring round the beautiful highland district in which the castle is situated.

# Battery Vehicles in Municipal Service

## The Public Cleansing Conference

IN connection with the thirty-fourth annual conference of the Institute of Public Cleansing, which was held at Manchester last week, an exhibition of vehicles and appliances at Belle Vue aroused much interest among the delegates.

Electricars, Ltd., Birmingham, who have specialised in the construction of electrically propelled low-loading vehicles for a considerable time, exhibited a 3½-ton "V.P." refuse-collection vehicle and a 2½-ton "V.Z." chassis. The "V.P." model was equipped with electrically operated hydraulic end-tipping gear and the "Electricar" patent sliding-shutter type of dustless covers.

A 2-ton low-loader, electrically propelled, exhibited by the General Vehicle Co., Ltd., was equipped with a wooden body and slatted canvas covers. The same company also showed a 3-ton short wheel base low-loader carrying a steel body. The capacity of the former is six cubic yards and of the latter ten cubic yards. Both models were equipped with twin underslung hydraulic tipping rams, electrically operated.

### Visits to Works

A visit to the works of the D.P. Battery Co., Ltd., at Bakewell, was an interesting item in the programme. The whole process of manufacture was demonstrated. "Kathanode" cells for use on submarines were shown to the party and a machine for testing ebonite containers at 20,000 V to ensure that they are perfect, was examined. Ranges of "Kathanode" plates and cells as used in electric vehicles were viewed, the important feature being the separator which protects the positive plates and prevents the formation of sediment at the bottom of the cells. The manufacture of lead linings for gun-fire batteries and the casting of battery plates were also demonstrated.

On June 8th members of the Institute visited the works of the Metropolitan-Vickers Electric Co., Ltd. The party was shown the various processes in the manufacture of electrical appliances from the production of vacuum cleaners to a finished motor generator for use by the Chinese Government. The switchgear department was visited and in the welding shop the party was shown the welding of very large castings and the light welding of smaller castings. Visitors were also taken into the high voltage laboratory and were entertained to tea.

A locomotive used on the Post Office tube railway equipped with a "Kathanode" battery

On June 10th a visit was paid to the works of the Chloride Electrical Storage Co., Ltd., when the various processes of battery manufacture were again demonstrated to the members of the Institute.

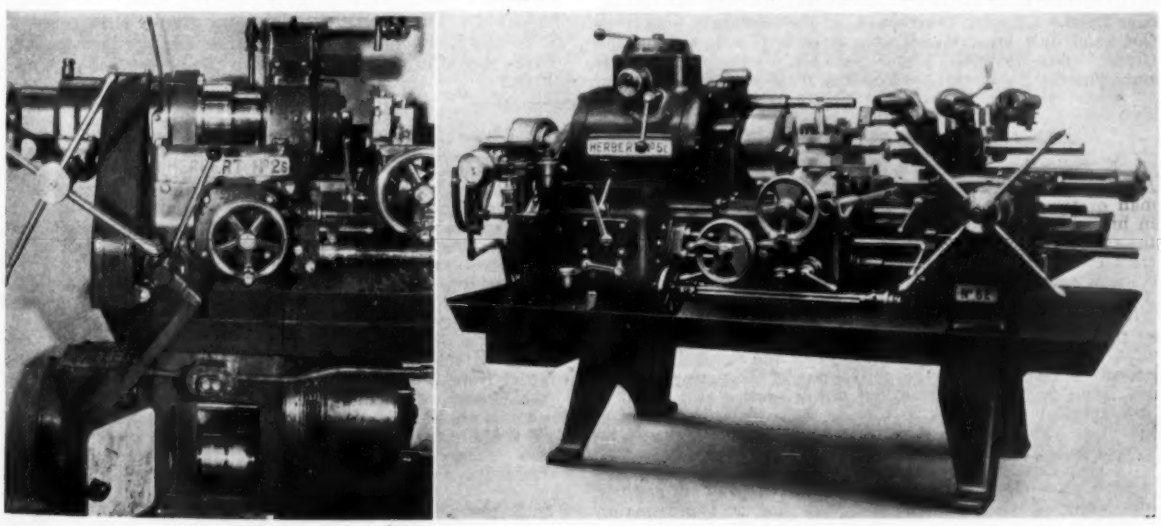
# New Electrically Driven Capstan Lathes

THE new capstan lathe No. 2S, recently produced by Alfred Herbert, Ltd., Coventry, meets the demand for a small self-contained motor-driven lathe. It is enabled to run at the highest speed that the tool or work will stand by the use of anti-friction bearings for the spindle and all shafts.

The lathe is driven by a 3 h.p. motor for a.c. or d.c. supply, the lever operating the starting switch on the top of the headstock providing finger-tip control. A special patented arrangement of the driving box enables a very wide range of spindle speeds to be obtained, while the three pairs of pick-off gears in conjunction with the three-step cone pulley provide twenty-seven spindle speeds, shown on the plate. The change from each of the nine fast speeds to one of the two slow speeds can be made instantaneously by means of the multiple disc clutch operated by the ball-ended lever at the headstock end of the bed.

The gears housed inside the driving box are made of chrome-nickel steel, and the saddle, which is moved along the bed by a hand wheel, has an adjustable stop in either direction, and the capstan slide has two changes of automatic feed and six self-selecting stops. The lathe is supplied with a draw-in chuck and automatic bar feed, which will take bars 1¼-in. in diameter. It can also be obtained with a 6-in. Coventry concentric chuck or a 6-in. Herbert air-operated chuck working at a pressure of 80 lb. per sq. in.

Another new model produced by this company is the No. 5E, which has an all-electric headstock and is designed for high-speed chucking work made from non-ferrous metals. The headstock is a 3-h.p. four-speed squirrel cage induction motor with the rotor mounted on the main spindle of the lathe. The selector switch, which is built into the top of the headstock, provides finger-tip control for all four speeds (500, 750, 1,000 and 1,500 r.p.m.). The spindle is mounted on anti-friction bearings, taking both journal and thrust loads.



Two new "Herbert" motor-driven capstan lathes—the 2S and the 5E

### Consulting Engineering

The annual report of the Association of Consulting Engineers for the year 1931-32 shows that the membership totals 129, and that the income of £325 was £40 in excess of expenditure. The year was a trying one for most members and it is felt that the time has come for the Association, in its corporate capacity, to take further steps to make the consulting profession better known to the public, and the possibilities of "corporate publicity" are being considered.

# Legal

IN the King's Bench Division on June 8th, Mr. Justice Lawrence continued the hearing of the action by Radiovisor (Foreign and Colonial), Ltd., against Radiovisor Parent, Ltd., claiming £200,000 damages and the return of or cancellation of 120,000 £1 shares on the grounds of alleged misrepresentation when defendants sold to the plaintiffs the foreign rights in a selenium light bridge. The defendants denied plaintiffs' allegations.

Further evidence was called for plaintiffs to show that in 1928 the cost of manufacturing the bridges was 8s. 2½d. each. In 1929 the cost, including an allowance for overhead charges, increased to 11s. 9d. per bridge. The managing director of the plaintiff company, Mr. Hugh Terrell, was recalled, and in reply to Sir Stafford Cripps, K.C., for defendants, said Dr. Burgess was interested in the American rights of the bridge, and he disclosed to him that it was inconstant in resistance.

Sir Stafford Cripps said that it was for the plaintiffs to prove that the representations alleged were made. Counsel did not think there was any great difference between the prospectus and the verbal representation. The whole gravamen of the case was upon the constancy and the operations of the bridge, and the operation of the Barnes lighting units, both of which were mentioned in the prospectus.

The plaintiffs had also to prove that the representations were made with the object of being passed on to the company. It was quite clear that the representations that were made to the material people were made in connection with the formation of the company. The Duke of Atholl understood substantially that this was a lighting unit which worked, and the question for the Court was what was the state of mind of these directors when they came to the arrangement to sign the contract. Further, it had to be proved that the plaintiff had relied on the representations in entering into the contract; whether they were untrue in material particulars and whether the defendants, or their agents who made them, knew at the time they were not true.

He submitted that there was practically no evidence of any sort on this point. The other aspect was whether the representations were made recklessly, not caring whether they were true or not. On this point he contended that there was a difference between the optimism of an inventor and fraud. It was not sufficient for someone to say that he relied on this or that phrase, which was used and which turned out to be inaccurate, or too optimistic in the light of after events. Here the substance of matters must be looked at and not any casual phrase that was used. He submitted that the whole story put forward by the plaintiffs had been grossly exaggerated. There might have been difficulties, and the plaintiffs might have been unfortunate, and it might have been that the bridges were not so useful as they were thought to be, but that was vastly different from saying that the defendant company had not made a commercially useful article.

Evidence was given by Dr. Burgess, President of the Burgess Battery Co. of New York, that with certain qualifications the selenium light bridge was, in his view, a practical and workable proposition.

The hearing is proceeding.

### Callender's Fined

At Dartford on June 10th Callender's Cable and Construction Co., Ltd., were summoned under the Factory and Workshop Act in respect of an insufficiently guarded machine. It was stated by the prosecution that a boy employed at the defendant company's works had some fingers severed by the machine. The company pleaded guilty and a fine of £70 was imposed.

# Parliamentary Notes (BY OUR SPECIAL REPORTER)

ON June 8th, Mr. Hall-Caine asked the Minister of Transport if he had any statistics showing the increase in the consumption of electricity which had resulted from the grid scheme, and whether he was satisfied with the progress of the arrangements for the distribution of electricity from that scheme.

Mr. Pybus said that the sales of electricity by authorised undertakers had increased from 5,723 million kWh in 1926 to 9,386 million kWh in 1931. It was not possible, however, to estimate to what extent the increases during the last two or three years could be attributed to the grid schemes which were progressing satisfactorily.

### A Glasgow Scheme

In reply to a question by Mr. McGovern as to whether any decision had been arrived at in connection with the taking over by the Glasgow Corporation of the electricity supply in the Sandyhills area, which was at present supplied by the Clyde Valley Electrical Power Co., Mr. Pybus said that his only jurisdiction in this matter was to appoint an arbitrator to determine certain questions which had arisen between the Corporation and the company. He understood that the decision of the arbitrator had now been given.

### The Leatherhead Undertaking

Mr. H. Williams asked the Minister whether the approval of the Electricity Commissioners to the purchase by the London and Home Counties Joint Electricity Authority from the Leatherhead and district undertaking for the sum of £312,540, assets which stood in the books of the latter at £230,148, was based on general considerations or was the result of special circumstances.

Mr. Pybus replied that the undertaking (comprising both fixed and liquid assets) was purchased on the basis of a going concern and the value did not depend wholly on the value of the fixed assets.

### The Bournemouth and Poole Bill

In the House of Commons on June 6th the Bournemouth, Poole and Christchurch Electricity Bill was read a second time.

# Colliery Electrification on the North-East Coast

AN indication of the trend of electrical development in collieries was afforded by Mr. R. P. Sloan, C.B.E., chairman of the Newcastle-upon-Tyne Electric Supply Co., Ltd., in his address to shareholders at the last annual meeting of the company, when he mentioned that negotiations had been completed, during the past year, for the closing down of twelve colliery generating plants, aggregating 20,000 h.p., all situated within the North-East Coast area of supply.

We asked Mr. Sloan to state his views on the development of the colliery load in his company's area and were informed that, in addition to the displacement of the generating plant already referred to, a further 22,000 h.p. of steam engine plant has been, or will shortly be, put out of service as a result of the company's activities to further the use of electricity at collieries. The electrification of several large collieries is included in the latter figure.

In one case, the new electrical equipment includes over 2,500 h.p. of air-compressing plant and two winding engines, the larger of which will have a peak load of approximately 2,800 h.p., and will be capable of winding 200 tons per hour from a depth of over 1,500 ft. In another case, the new plant will include 1,170 h.p. of electrically-driven air-compressing plant and three electrical winding engines, with peak loads aggregating over 4,000 h.p. At another colliery the new plant will include 750 h.p. of electrically-driven air-compressing and ventilating equipment, as well as an electrical winding engine with a peak load of 1,800 h.p.

Five or six additional collieries of the 600 to 1,000-tons per day class, and several smaller ones, have installed or ordered the necessary equipment to electrify completely, and a number of others have completed or made arrangements for the electrification of the auxiliary plant, leaving only the winding engines still to be dealt with.

### Reducing Working Costs

The coal companies' efforts to reduce their working costs have been responsible for an appreciable increase in the amount of machinery installed at the coal face, mainly coal-cutters and conveyors for direct electrical operation, or where colliery conditions necessitate it, indirectly operated by compressed air. The competition for orders (at fixed prices) is necessitating more attention being given to improving the quality of the coal, and is responsible for the installation at several collieries of new screening and cleaning plants, all of which call for the extended use of electrical energy.

More than usual attention is being devoted at the present time to the possibilities of effecting economies by the extended use of electricity supply, owing probably to the general consideration that is now being given to the alterations necessitated by the change of frequency from 40 to 50 cycles, but, apart from this, there is ample evidence that, on account of the economic difficulties which the coal trade is experiencing, owners are devoting their attention to a detailed examination of the advantages to be obtained from the modernisation of the collieries' power equipment and the more complete mechanisation of the mines.

### How Manufacturers Assist

In consequence of trade conditions, the majority of the collieries are now working at restricted output or are temporarily closed, but in spite of this, the net load supplied to them from the company's system during the past year shows an advance as compared with any previous year, indicating that a very marked increase in this class of load will occur with an improvement of conditions in the coal trade.

One of the main difficulties to be met in considering the conversion from steam to electrical operation of a large power installation is the capital expenditure necessary, but this is now to some extent being overcome by the assistance which the larger electrical plant manufacturers are generally willing to afford in the carrying out of such work, by an extension of the periods of payment where large sums are involved.

At the end of last year there were no fewer than 180 collieries connected to the company's system. That so large a number are taking a public supply for the working of their pits —which includes the important services of winding, pumping, and ventilating—is the best testimony to the high degree of reliability of supply that has been attained.

# Correspondence

*Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession*

## Switch Safety

Although wiring rules have one end in view, the safety of life and property, the most important rule of all is often violated, and single-pole switches are still fitted in neutral wires.

Directions for testing for switch safety are seldom found in text books, and, when they are given, they are generally wrong. Thus one well-known text book gives a method of ascertaining whether all switches are connected to the same pole, but ignores the possibility of their being all in the return wire. Only last year a very practical text book was published which gave full details of how to identify the positive and negative wires—a matter of no importance, the important question being: which is the live wire?

The proper way to test whether the switches in a completed installation are connected in the live circuit is simple, and should be included in every text book and in the Regulations for the Electrical Equipment of Bulidings. It should also be regarded as an essential test by every supply undertaking when connecting up a new installation. This test is as follows:—Switch on the lights, remove the s.-p. switch cover, and through a test lamp connect the switch terminals to the nearest earth; if the test lamp lights up the switch is connected in the live wire. The electrician applying this test need not consider whether the circuit is fed from the positive or negative outer of a d.c. supply, and the method is equally applicable to a circuit which is supplied from a four-wire a.c. system.

The electrician has only to carry a Home Office type of bakelite lampholder with a wire of suitable length connected to each terminal and a lamp of the appropriate voltage. If a supply of electricity were refused by the undertaking until every s.-p. switch had been shown to be connected to the live wire, it would bring nearer the day when fuses will be required only in the live wire of each circuit.

I have adopted the term "switch safety" as I know something of the confusion caused by talking of "switch polarity" in connection with this test. E. O. CATFORD.

Edinburgh, *June 3rd*, 1932.

## A New Company's Objects

In your issue of June 3rd under "New Companies Registered," we note that you mention the objects of Lionel Robinson & Co., Ltd., as "manufacturers and dealers in electrical and other lamps, reflectors, bells, cookers, &c."

Your correspondent has taken the objects from the first paragraph of the "Objects of the Company" in the Memorandum of Association; these are merely the usual wide clauses.

The business will be carried on exactly as before, as distributors of resistance alloys, refractories and supplies of raw materials to electrical manufacturing firms. We do not wish to give customers the impression that we are going to manufacture in competition with them, which is entirely against our principles. LIONEL ROBINSON & CO., LTD.

Lionel Robinson, *Director*.

London, W.C.1, *June 10th*, 1932.

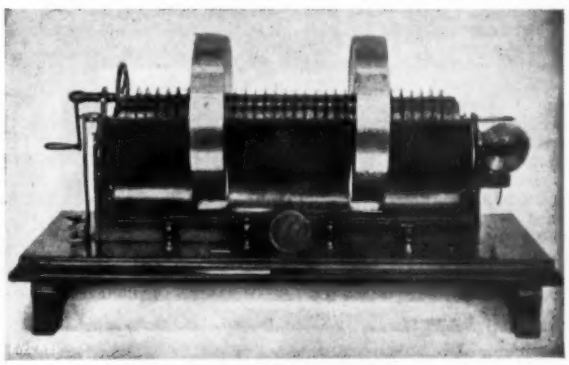
## Varley's Claim Contested

Our attention has been drawn to the very interesting article appearing in your journal of March 18th, on the invention of the very first self-excited dynamo-machine. According to this, the credit for this invention should be given to Samuel Varley, who accomplished it in 1866, ahead of the similar constructions of Siemens and Wheatstone. Nevertheless, we presume to call your attention to the fact that there existed in Hungary—as has very often been the case with great inventions—another construction upon the self-excitation principle, years before that of Varley. This was the self-exciting dynamo of Anian Jedlik, professor of Physics at the Royal Hungarian University, Budapest.

**Anian Jedlik**

Jedlik was born in 1800 and he produced an electromagnetic rotor in 1828, a kind of electromotor embodying the principle of the commutator. This rotor was demonstrated before the meeting of the Association of Hungarian Physicians and Natural Scientists at Budapest. Later on he was engaged in perfecting the sources of electrical current of those days, the Bunsen cells. His cells won a prize at the Paris Exhibition in 1855, against those of Bunsen. He also experimented successfully in the magnetisation of steel rods and in condenser construction, but his greatest success was the invention of the dynamo machine.

The construction of this machine was begun as early as 1851, but there is no record of the time of its completion. The machine was of the unipolar type and Jedlik added a technical description for operation, in the fourth part of which there is clearly pointed out the feed-back, or self-exciting principle.



**Jedlik's unipolar self-excited dynamo**

Jedlik, being a professor absorbed in science, had no mind for the commercial exploitation of his invention. Moreover, Hungary, not being a place for industrial development in those days, he did not seek greater publicity for his invention, the consequences and future enormous development of which he could not foresee.

I do not desire to throw doubts upon the merits of other inventors, as their genius, not knowing about one another's work, was just as genuine, and the comparatively short distance in years of their inventions does not really matter. However, I believe that mentioning and recognising the merits of the very first inventor will help to make the picture of this age of electricity complete.

All documents concerning this matter and the machine itself are to be found in the Physical Institution No. 1, University of Science, Budapest. The dynamo, the electromagnetic rotor, and Jedlik's other instruments were exhibited at the world exhibition of electrical communication held in honour of Volta at Como, Italy, in 1927. B. PASKAY, *Director-in-Chief*,

Electrical Communication Laboratories,

Budapest, *June 7th*, 1932. Royal Hungarian Post.

## E.H.P. Switchgear

Your correspondent "Anon" has evidently some experience in the design and operation of modern switchgear, which, when purchasing or advising the purchase of present-day requirements in that direction, it is very desirable to possess.

Modern switchgear design and manufacture is, without doubt, a specialist's job and if the intending purchaser does not happen to possess the necessary experience to enable him to use his own discretion when being "sold the idea" by a high-pressure sales engineer, he should obtain the advice of an impartial engineer who has been through the mill and found out the "niggers." This man is not at all impressed by stunt advertising in the technical Press. We engineers might easily be buying vacuum cleaners or sore-throat-proof cigarettes to read some of them.

I strongly support "Anon's" view that the leading manufacturers can and do manufacture oil circuit breakers which are adequate in design and perfectly capable of carrying out their rated duty. Their designers, some of them eminent engineers, base their calculations on known phenomena and although they may not, like "Anon's" bridges, be actually tested it is obviously more than the reputation of the company is worth to produce a C3 design. IMPARTIAL.

*June 8th*, 1932.

It appears that in his letter appearing in your issue of May 27th Mr. L. J. Bamber's "countless trials and tests" referred to experimental work necessary to obtain data for the successful design of circuit breakers, and I agree with him that preliminary research is essential in the design of switchgear as indeed it is with any apparatus or process. Mr. Bamber asserts that new and improved types of circuit breakers cannot be developed commercially on the basis of experience. I cannot conceive on what other basis a new and improved type of anything can be developed, since such experience must include trials and tests. Even an inspiration must be tried and tested before it has any commercial value.

I was not, however, writing of new and improved types of circuit breaker but rather of manufacturers' standardised commercial products. Surely there is in the numbers of circuit breakers in satisfactory service ample evidence to show that many of the experienced manufacturers have that accumulated knowledge and experience behind them which enables them

to produce circuit breakers which perform the duties for which they are designed with a requisite factor of safety. It is true that on rare occasions circuit breakers by makers of experience and standing have failed in service but since, under working conditions, there is an entire absence of the indicating and recording apparatus necessary for showing exactly what has taken place in a circuit breaker at the time of failure, no advocate of scientific investigation can draw any logical conclusion from the isolated occurrences.

Analogies are admittedly dangerous but the bridge analogy was quite good if not misinterpreted. The earthquake conditions were distinctly referred to as phenomena requiring research. On the other hand, one regards the withstanding of short-circuit stresses by a circuit breaker as part of its normal duty—analogous to a condition of load on the bridge. The testing of the Sydney Harbour Bridge by seventy locomotives was a perfectly justifiable and necessary assurance, but it may be confidently assumed that had there been thought to be one chance in ten thousand of the bridge failing under test it would never have been built. To complete his answer, Mr. Bamber should tell us whether the test took place at the contractor's works before the order was placed, whether the contractor supplied the seventy locomotives, and whether he has since displayed any astonishment at the successful test.

That circuit breakers have to be sent abroad to be tested is a fit subject for bitter jibe, but I intended no jibe at the very competent foreign engineers who do our testing. I have remained anonymous to prevent my observations from being ignored on the grounds of the interestedness of their author. It was hoped to provoke a profitable commonsense discussion, unobscured by technicalities, amongst makers and buyers of switchgear on the following questions, which would be the healthier for a thorough airing:—

(*a*) What is rupturing capacity? Under what conditions and by what methods is it determined?

(*b*) Should every circuit breaker be tested for rupturing capacity, the test being a proving test and not to be confused with research work?

(*c*) Who is to provide facilities for such tests? It is obviously uneconomic for each maker to possess a proving house.

*June 13th*, 1932. ANON.

## The Irish Free State Tariffs

In your issue of May 20th I stated that the I.F.S. Government had not, and was not likely to, impose import duties upon electrical goods other than wireless sets and components. Since then, alas! contractors and importers have become aware that duties have been imposed upon certain materials, which have the same effect as if there were a specific tariff upon electrical goods.

The Dublin manager of the largest importers of electrical goods tells me that he is waiting for the situation to clarify itself with respect to the possible incidence of these duties on his business, for he thinks that the Ministers of Industry and Commerce and of Finance may not have foreseen all the implications involved, and probably do not wish to hamper the development of the national electricity undertakings by imposing protective duties upon articles which under no conceivable circumstances could be manufactured in Ireland for the comparatively insignificant Irish market.

He informs me that certain helpful specific rulings have been made already; for instance, brass-covered switches and all brass lampholders are liable, but bakelite-covered switches and bakelite holders are exempt; black and galvanised conduits, being made of mild steel are exempt, but a test case may have to be made of cast conduit fittings. On the other hand, there seems to be no hope for lighting fittings made mainly of brass; and wood blocks may come within the classification of builders' woodwork, in which case the great difference in rates of duty under the respective sub-heads should be noted.

I understand that lead-covered cables are likely to be exempted, but the point was under consideration at the time of my interview. All other cables, of course, are free. The brass caps of lamps are not sufficiently important components of the complete article to bring the lamps under the impost.

It will have been observed that a big increase has been made in the duty already imposed on wireless sets, and that there is now no preferential rate for materials made within the British Commonwealth; but my informant states that, as the result of strong representations made by the trade, the position for the moment is that all wireless material can be cleared upon payment of a deposit pending reconsideration of the new duties.

Viewing the matter generally, I feel that opinion has tended to be more alarmist than the facts warrant, and that the electrical trade will find itself very little worse off than before.

Dublin, *June 13th*, 1932. OBSERVER.

## City and Guilds Examinations

I feel that it is desirable to criticise in a friendly manner some points in the papers set for 1932 in connection with the City and Guilds examinations in electrical installation work.

The present standard of knowledge attained by installation wiremen is ridiculously small, but this does not mean that a purely scientific knowledge is required; such a requirement would kill all attempts at educating this class of worker. Course B is clearly intended for wiremen, and Course C for foremen wiremen; the papers should, therefore, be of such a character that the issue of a certificate would imply that the examinee was a proficient wireman or foreman. No more is required, and the papers should not be designed to make the men pass a disguised examination in electrical engineering.

I maintain that the City and Guilds syllabus is in some respects too advanced, and is liable to drive good workers out of the classes. Every technical college tells the same tale; starting with, say, sixty students, only half a dozen may attend during the fourth year.

The first paper of Course B leaves no room for adverse criticism. The second paper is excellent, but two points call for comment. The examiner probably does not intend the student (in Question 4) to make allowance for lapping, but the question of resistance to four figures is far beyond the range of a wireman's work; in fact, he should have been taught to avoid using such precise figures, unless all the necessary conditions are specified. Question 5 is outside the syllabus, and a wireman could not be expected to calculate the energy stored in a cable. Question 2 of the first paper of Course C relates to armature winding, and could not be answered by the average good foreman. The second paper, in Question 1, calls for working drawings of a magneto-ringing bell, and gives an unfair advantage to the telephone men. Other questions might be mentioned that are entirely out of place and which would floor many really first-class foremen.

The only object of my criticism on papers that are otherwise good is to keep the level of these papers down to that of the syllabus. The man who has passed through these courses can, if he wishes, go on to "Electrical Engineering Practice," where a fuller and more technical standard is rightly demanded. F. PEAKE SEXTON.

Surbiton, *June 3rd*, 1932.

## Power Factor Improvement

We have read Mr. D. Dyson Rayner's letter in your issue of June 10th. In case any person may be misled by Mr. Rayner's last letter with regard to the patent situation, we desire to state that we are prepared to support our patents on this subject against any attack upon them, and we shall not countenance any infringement. It is not proposed to continue this correspondence.

THE ELECTRIC CONSTRUCTION COMPANY, LTD.,
James Gray, *Managing Director*.

London, W.C.2, *June 14th*, 1932.

## Delegates to the I.M.E.A. Convention (*continued from page 873*)

W. P. Lilwall (Fleetwood), R. E. Livesley (Newark), R. Lomax (Hazel Grove), F. M. Long (Norwich), J. H. Lumsden (Stalybridge), J. R. P. Lunn (Darlington), R. V. Macrory (Londonderry), T. A. G. Margary (Wolverhampton), H. Marsden (Henley), W. J. Marston (Coventry), T. R. Martin, M. S. Mason (Worksop), F. V. L. Mathias (Warrington), P. M. Maxwell (Batley), D. McDougall (Greenock), C. F. McInnes (Gravesend), A. E. McKenzie (Wimbledon), G. C. McLean (Inverness), N. McLean (Harrogate), E. A. Mills (Halifax), G. C. Milnes (Lancaster), C. O. Milton (Maidenhead), Lady Moir (E.A.W.), A. Nichols Moore (Newport, Mon.), E. Morgan (Sheffield), M. J. Mortimer (Morecambe), H. Morton (Llandudno), J. Mould (Leicester), A. M. Mulliner (Middleton), Major J. Murphy (B.E.A.I.R.A.), W. R. Murray (Stirling), C. J. Neale (Siemens Elec. Lamps), H. A. Nevill (Peterborough), E. S. New (D.P. Battery Co.), F. Newey (Long Eaton), F. Nicholls (Derby), E. J. Nichols (York), A. Nicklin (Swindon), G. Nicolson (Weymouth), F. L. Ogden (Oldham), G. H. Oldroyd (Stockport), Sir Archibald Page (C.E.B.), H. H. Parker (Pudsey), J. H. Parker (L.C.C.), W. A. Parker (Workington), R. H. Paterson (Hammersmith), L. C. Penwill (E.C.A.), R. W. L. Phillips (Bedford), A. Pickersgill (Spenborough), H. C. Pierson (Met. Vick.), J. W. Piggott (Whitby), G. Porter (Worthing), J. G. Potts (Bury), G. G. L. Preece (Bruce, Peebles), F. W. Purse, P. J. Pybus (Minister of Transport), H. Raine (Annfield Plain), P. N. Rand (English Elec. Co.), W. R. Rawlings (E.C.A.), F. N. Rendell-Baker (Croydon), C. G. Richards (Port Talbot), A. J. Richardson (Hawarden), E. K. Richardson (Tilbury), W. H. Robins (Stafford), I. V. Robinson (B.E.A.M.A.), P. J. Robinson (Liverpool), T. Roles (Bradford), L. Romero (Salford), A. E. Roots (Dumfries), W. A. Royle (Blackburn), A. J. Ryan (Hastings), P. E. Rycroft (Great Yarmouth), C. W. Salt (Carlisle), R. H. Schofield (Ferranti), R. H. Scotson (Middlesbrough), J. Scott (Formby), E. Seddon (Edinburgh), R. O. Seville (Wakefield), C. M. Shaw (Worcester), T. S. Shenton (Rugby), J. E. Shepherd (Rawtenstall), J. S. Simmons (Henley's), J. F. Simpson (Preston), C. A. Smiles (Eng. Elec. Co.), W. J. Smither (Dorchester), W. V. Smythe (Skipton), L. A. Snow (B.T.-H. Co.), G. Sommerville (Faversham), G. E. Soulsby (Tanfield), J. W. Spark (Bath), H. C. Spence (Holmfirth), F. E. Spencer (Birkenhead), G. R. Spurr (Walthamstow), C. H. Stagg (Eston), C. W. Sully (E.L.M.A.), H. H. Sutcliffe (Hebden Bridge), F. Swarbrick (Hove), C. D. Taite (I.A.E.P.C.), J. E. Tapper (Beckenham), W. C. P. Tapper (Stepney), H. J. Taylor (E.P.E.A.), D. Thomas (Abertillery), T. S. Thomas (Bedwas and Machen), J. H. Thompson (Colne), S. Tillotson (West Hartlepool), J. W. J. Townley (West Ham), C. Turnbull (Tynemouth), W. A. Turnbull (Aylesbury), Capt. C. J. Turner (Hoylake), J. W. Turner (Huddersfield), W. G. Turner (Southampton), Col. W. A. Vignoles (Evershed & Vignoles), J. N. Waite (Hull), Ald. W. Walker (C.E.B.), W. A. Walker (Kettering), P. Wardle (Cannock), V. Watlington (B.E.A.M.A.), Lt.-Col. H. W. Watts (Epsom), H. Webber (Keighley), J. Wetherell (Leyton), P. F. White (Bangor), F. H. Whysall (Belfast), T. Wilkins (Penybont), H. Wilkinson (Radcliffe), J. C. Williams (Erith), J. W. Williams (Wrexham), R. W. Willis (Cheadle), H. Wilson (Ashford), C. J. Wood (Sale), E. D. Wootten (Malvern).

# Business and Industrial Notes

**The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures**

## Scientific Management

The fifth International Scientific Management Congress at Amsterdam, to which reference is made in our leaderettes to-day, follows the Paris Congress of 1929 and has been organised by the International Committee for Scientific Management. Management combines both art and science and it is in the proper balance between these two sides of industrial control that the most successful solution to modern problems must lie. The Congress will reveal the lines of thought of executives and technicians from many countries, moving towards the solution of common problems in the industrial life of the world. Each industrial country will contribute papers through the national central body concerned. In Great Britain a Committee has been formed from representatives of the chief associations dealing with management and its technique, including the Business Research and Management Association, Management Research Groups, the Industrial Welfare Society, &c. This Committee has its headquarters at 23, Bloomsbury Square, London, W.C.2.

## "Creda" Showrooms at Cardiff

Credenda Conduits, Ltd., in co-operation with Messrs. Haslam & Stretton, Ltd., have opened large showrooms at Cardiff. Situated in the centre of the city, the new all-electric showrooms are very spacious and are equipped with the latest designs of cookers, fires, tubular heaters, electric irons and various other "Creda" appliances. There are also large stock rooms and facilities for demonstrations. The official opening ceremony took place on Monday last and was performed by Mrs. C. G. Morley New (chairman, Cardiff branch of the E.A.W.). Mr. S. B. Haslam, in proposing a vote of thanks to Mrs. Morley New, said that in opening the showrooms they were preparing for better times which were bound to come. A cordial invitation was extended to the Cardiff branch of the E.A.W. to hold its meetings and attend demonstrations at the showrooms. Mr. Haslam paid a tribute to Mr. C. G. Morley New, this year's president of the I.M.E.A. Those present included Sir Charles Bird, Mr. and Mrs. Theodore Stretton, Mrs. and Miss Haslam, Mrs. Arthur Ellis, Mrs. John Allcock, Mrs. C. T. Allan, Mr. E. A. Edwards (managing director of Credenda Conduits, Ltd.), and Mr. F. G. Nesbitt (general sales manager). The accompanying illustration shows some of the ladies present, including Mrs. Morley New.

**A group at the "Creda" showrooms, Cardiff, including Mrs. C. G. Morley New**

## Electrical Imports and Exports in May

During May, exports of electrical apparatus and machinery amounted to £781,221, which compares with £887,464 in April and with £941,260 in May, 1931. Electrical imports at £222,710 were £26,680 higher than in the preceding month, but £296,865 below the April, 1931, figure. A detailed analysis of the May trade will appear in our next issue.

## A "Revo" Window Display

The accompanying illustration shows a window display of electric cookers and fires prepared by the Revo Electric Co., Ltd., which is making a tour of the branches of the Shropshire, Worcestershire and Staffordshire Electric Power Co. Features of the display are an enlarged facsimile of the company's "Superspeed" plate which is illustrated by means of neon lighting, and an attractive illuminated showcard presenting the usefulness of electric fires.

## A British Copper-refining Enterprise

A company with the title of British Copper Refiners, Ltd., has been formed with the object of producing high conductivity copper for electrical purposes. It is closely associated with British Insulated Cables, Ltd., which will thus be able to supply consumers of copper and copper products from a refinery which, it is claimed, will be the first of its kind in Great Britain.

The raw material will be delivered to the works in the form of blister copper, and the finished products will embrace copper bars, billets, cakes and slabs.

The initial maximum output of the first section of the plant will be 1,000 tons per week, but provision is being made for future extensions of buildings and machinery. Work has already been commenced on the site at Preston, Lancs., and it is expected that the plant will be in production towards the end of the year. The raw material will be imported from the Roan Antelope Company's mine in Rhodesia.

## Patents in 1931

The report of the Comptroller-General of Patents, Designs, and Trade Marks for 1931, shows that the number of applications for patents received was 36,117, as compared with 39,359 in 1930, the number of provisional patents declining from 24,477 to 22,850, and complete patents from 24,993 to 22,838. The number of patents sealed rose from 20,765 to 21,949. The number of designs and trade marks registered was 17,685 and 6,016 respectively, as compared with 20,169 and 6,728 in 1930. The Comptroller-General says that in the electrical industries the establishment of the grid system is still responsible for much invention. Switchgear is being devised in which

**A display of fires and cookers arranged by the Revo Company**

air or vapour blasts are used for quenching the arc, and oil is either dispensed with or employed only in small quantities. In connection with the conversion and transformation of electricity, there is a growing tendency to replace moving coil elements by static devices, involving mercury arc and similar discharge apparatus. Electric discharge lamps are being developed for advertising and general illumination purposes. In connection with wireless signalling, receiving sets are being improved with the object of obtaining good selectivity without sacrifice of quality, and attention is being given to the redistribution of broadcast programmes by land lines and by the use of short waves over densely populated areas. There is a marked increase in the number of inventions concerned with telegraph exchange systems, employing the technique of automatic telephony, and of typewriting telegraphs for use therewith. In television, attention is being directed to the replacement of apertured scanning discs by other scanning means, such as reflectors, moving arcs and cathode rays. There has been an influx of inventions relating to clocks driven by electric power and particularly by synchronous motors.

### Central Electricity Board Contract

The Hart Accumulator Co., Ltd., has received an order from the Central Electricity Board for nine "Hart" batteries—each consisting of 55 "STB" type cells—for installation in the following transforming stations of the South-West England and South Wales Scheme: Melksham, Newport, Tir John North, Portishead, Cardiff, Swindon, Gloucester, Upper Boat and Oxford.

### A Year of Opportunity

Speaking at the annual convention of the Advertising Convention last Monday, Sir William Clare Lees said that it was imperative if this country was to survive industrially, that when the time came and world conditions improved, we should not only participate in the general revival, but also recover some of the ground we had lost previous to 1929 when the general decline in world trade began to make itself felt. A rise of 20 or 30 per cent. in the price of primary products would do more to put the world right than all the collective actions of Governments could ever achieve. Great Britain was now in a better position to compete with other countries than had been the case for a number of years, and it would be madness to attempt to go back to the Gold Standard at the present time. It was the fact that British goods were not only best in quality but also, in many cases best in price, that made this year one of opportunity.

**Members of the Electrical Power Engineers' Association who paid a visit recently to Callender's works at Leigh, Lancs.**

### Recent Contracts

The British Electric Transformer Co., Ltd., has received a renewal contract for "Kye" vacuum and gasfilled electric lamps from the London County Council for the whole of its supplies for the coming twelve months. The company has also received a contract for vacuum and gasfilled lamps from the Government of Northern Ireland, and part contracts from Edinburgh Corporation and the War Office.

### An Ediswan Lighting Installation

With reference to the note which appeared in our June 3rd issue regarding the illumination of the Leicester Permanent Building Society's new building we are informed that Messrs. Tarratt Bros., 28, Brandon Street, Leicester, were the contractors of this installation. Although "Ediswan" engineers designed the lighting of the dome, Messrs. Tarratt Bros. were responsible for the remainder of the lighting.

### An Inquiry for Stage Lighting Apparatus

We are informed that a French company contemplates the sale of stage-lighting apparatus in France and wishes to be put into touch with British manufacturers of this class of apparatus.

### Electricity Showrooms for Aldershot

The Town Council has decided to proceed with a £10,000 scheme for the provision of electricity showrooms at the corner of Victoria Road and Station Road.

### Battery Price Cutting

In the Chancery Division last Friday Mr. Justice Farwell granted the Ever Ready Co. (Gt. Britain), Ltd., an injunction, with costs, against the C.P. Wireless, Ltd., Bedford Row, restraining them from infringing plaintiffs' letters patent by selling plaintiffs' electric batteries below the price fixed in their limited licence. His Lordship also directed an inquiry as to damages suffered by the plaintiffs. The patents dealt with the construction of high-tension wireless batteries, known as "Winner" batteries, which were sold under a limited licence. Defendants appeared by Counsel but took no part in the proceedings.

### A Hotel Installation

Referring to our note on the electrical installation at the St. Austell Bay Hotel in our issue of June 3rd, the Midland Electric Manufacturing Co., Ltd., asks us to state that the G.E.C. did not manufacture the "M.E.M." fuseboards and the "Deeble" service switches included in the installation.

### Registered Electrical Contractors

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Contractors at its last meeting:—

Dale End Radio-Electric, Birmingham.
Bostock, Frederick V., Chorlton-cum-Hardy.
Wilson, John V., Bromsgrove.
Cooper, William, Higher Crumpsall, Manchester.
Bryan, L. W., Birkenhead.
Snell, Albert S. W., Higher Tranmere, Birkenhead.
Evans, S., & Sons, Ltd., Maidenhead.
Gaillard, Robinson & Co., S.W.1.
Reavell Bros., Ltd., Alnwick.
Seymour, P., & Co., Birkenhead.
Craig, R., & Sons (Engineers), Ltd., Belfast.
Central Electric Co., Rushden.
Megs Electrical Co., Ltd. W.1.

At the same meeting three applications were withdrawn, and nine declined.

### The American Electrical Industry

Statistics published in the May issue of the *Survey* of the National Electrical Manufacturers' Association (U.S.A.) relating to the activities of its members during February and March show generally a slight improvement over the preceding two months. Compared with the corresponding months of 1931 orders received for a.c. motors (1-2,000 h.p.) at $2,027,422 were $1,617,061 lower, the demand for d.c. motors (1-2,000 h.p.) also declining from $847,163 to $459,288; fractional h.p. motors ($2,249,534) were $1,232,507 lower. Power switching equipment was a particularly poor feature of the market, orders for indoor apparatus falling from $140,039 to $59,480, and for outdoor apparatus from $470,768 to $155,601. Electric furnace orders declined from $307,077 to $119,274. In most cases a larger number of companies reported this year than in 1931, so that it would seem that the existing trading conditions are actually somewhat more unfavourable than might be gathered from the above figures.

### Australian Duty on Oil Engines

At a recent sitting of the Australian Tariff Board the Sydney Chamber of Commerce asked for a reduction of the duties on Diesel and crude oil engines of 50 h.p. and over, on the grounds that crude oil engines were the only possible power units for many country electricity undertakings and that they were essential for industrial development.

### Extension of Woolwich Showrooms

The London County Council Finance Committee recommends the promotion of legislation to enable the Woolwich Borough Council to acquire compulsorily property in Powis Street for the extension of the electricity showrooms. Woolwich Council already holds an underlease of rooms on the first and second floors but has failed to secure the leasehold of the premises.

### Wallasey's Electricity Showrooms

Subject to the sanction of the Ministry of Health, the Wallasey Corporation is to erect electricity showrooms and offices on the Wallasey Road frontage of Conway Street.

### "Parofilm" Tape

The "Parofilm" tape which we described in our June 10th issue is manufactured by Messrs. Linday & Williams and not by Messrs. O'Brien and Hulme, who are the distributors for the electrical industry.

### Social Events

The annual outing of the Metropolitan Electric Cable and Construction Co., Ltd., took place on June 4th. A party of approximately 300 left the works at Chadwell Heath in a fleet of motor coaches and journeyed to Margate, where they were met by the chairman and managing director. Luncheon was served at Dreamland, after which the chairman made a brief speech. The party returned to Chadwell Heath at 11 p.m

The Croydon Cable Works played Hambledon Cricket Club on Saturday last upon the historic Broadhalfpenny Down. The Works scored 106 and the club batted twice for 33 each time. After the match the teams had tea together at the old New Inn, Hambledon.

The Brighton and District Electrical Trades Golfing Society held its first day meeting at West Hove Golf Club on June 8th. The successful competitors were:—Morning round: 1st, Mr. H. A. Deacon, of Messrs. Cryselco, Ltd.; 2nd, Mr. A. Geall, of Messrs. A. Geall. Afternoon round: 1st, Mr. J. Brown, of Pullar's Electric Signs, Ltd.; 2nd, Mr. W. F. Moir, of Messrs. Cryselco, Ltd. The hon. secretary, Mr. E. Colvill, 59, Ship Street, Brighton, will be pleased to supply particulars to any one connected with the electrical industry who would like to join the Society.

## The Danish Radio Market

According to a Department of Overseas Trade report, the latest statistics regarding the production of radio sets and components in Denmark show that Danish manufacturers had an output of almost 8½ million crowns worth of material in 1930. The total manufactured has rapidly increased since 1925, when the figure was Kr.1,535,000. In 1930 the total value of radio sets manufactured is given as approximately Kr.6,250,000, of which Kr.2,360,000 (22,800 sets) represents goods manufactured from parts produced locally, Kr.513,000 (5,100 sets) from parts of foreign manufacture, and approximately Kr.4,000,000 (24,800 sets) from parts the origin of which is not specified. Although the country's export trade in radio material is relatively small, she succeeded in increasing her export trade from Kr.261,000 in 1929 to Kr.353,000 in 1930, the greater part of the exports in 1930 going to Sweden (Kr.113,000), while Iceland took Kr.44,000, and the United Kingdom Kr.61,000. Imports of radio material from the United Kingdom are very small. Of a total of Kr.7,159,000 imported in 1930, the United Kingdom supplied only Kr.173,000, as against Kr.231,000 in 1929 and Kr.198,000 in 1928. Germany and Holland are the principal suppliers.

## Cable Manufacture in Japan

A large new factory, which, it is stated, will be able to supply the greater part of the cable requirements of Japan, is now in course of erection by the Sumitomo Cable Co. of Osaka.

## The Three Counties Show, Gloucester.

The West Gloucestershire Circle of the British Electrical Development Association, in conjunction with the Gloucestershire Agricultural Education Department, staged an all-electric poultry farm at the Three Counties Show at Gloucester

The E.D.A. Stand

on Tuesday, Wednesday and Thursday last week. This exhibit was an example of modern methods of egg and poultry production and preparation for market, using electricity for heating, power, and lighting.

## Trade Announcements

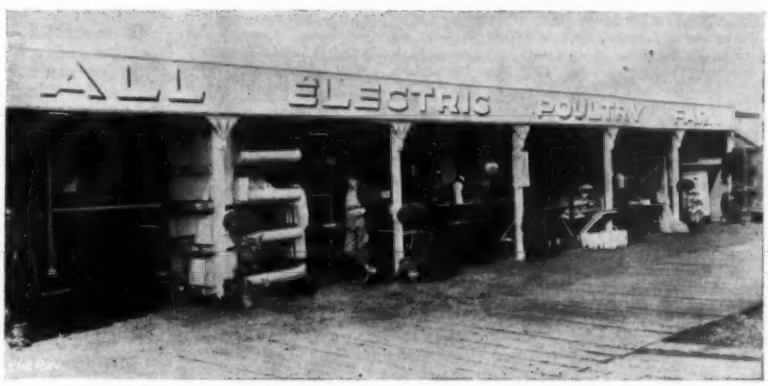
The offices of Lighting Trades, Ltd., have been transferred to 51-55, Garratt Lane, Wandsworth, S.W.18 (telephone, Battersea 6008). The company's City trade counter will remain at 17-19, Farringdon Road, E.C.1, and its showrooms at 30-31, Farringdon Street, E.C.4.

The "Attracta" Electrical Co. has leased a large "kiosk-showcase" for the display of "Attracta" signs and display devices at Grand Arcade, Grand Buildings, Trafalgar Square, London. The exhibits include: "Attravem" moving message signs for windows, etc.; "Aurora" globe signs, electric animated bubble signs, neon window signs and tubes; photographic transparency signs, and the new "effervescing" sign in which the electrolysis of water is adapted to give a realistic imitation of a sparkling glass of mineral water.

The Visco Engineering Co., Ltd., has removed to larger premises at Stafford Road, Croydon (telephone: Fairfield 4181; telegrams: Curtmit, Croydon).

## Johannesburg Library Installation

Mr. Perry, architect of the new Johannesburg public library building, has been empowered by the City Council during his visit to England to obtain proposals for heating, lighting, and ventilation, and a consultant is to be appointed in London to adjudicate. The scheme selected will be submitted to the City Council and tenders will be invited for carrying out the work.




The all-electric farm at the Three Counties Show

## For Sale

A freehold factory is offered for sale by Messrs. Hillier, Parker, May & Rowden.

The Northern Counties Electricity Supply Co., Ltd., invites tenders for the purchase of the generating plant at the Norton power station, Malton, Yorks.

Brighton Electricity Department has three boilers for disposal.

Messrs. Fuller, Horsey, Sons & Cassell offer electric motors for sale.

Tenders are invited by Hebden Bridge Urban District Council for the purchase of superseded d.c. plant.

Generating plant at the Dundalk power station is offered for sale by the Irish Free State Electricity Supply Board.

(See our advertisement pages to-day.)

## Prices of Materials

Messrs. F. Smith & Co. report, June 15th: Electrolytic copper bars, £36, 10s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £40, 5s. inc.; ditto ditto h.c. wire, 6½d., $\frac{1}{16}$d. inc. Silicium bronze wire, no change.

Messrs. Edward Till & Co. report, June 15th: India-rubber, Para fine, no change.

Messrs. James & Shakespeare report, June 15th: Copper bars (best selected), sheet and rod, no change. English pig lead, £11 5s., 10s. dec.

## New Catalogues and Lists

**Asea Electric, Ltd.,** 5, Chancery Lane, W.C.2.—Leaflet No. T.104, describing on-load tap-changing equipment.

**Arora Co.,** Loughborough.—Two illustrated and priced electric fire folders.

**General Electric Co., Ltd.,** Magnet House, Kingsway, W.C.2.—A folder (No. V.6240) giving details of the new season's range of "Magnet" fans. Also an illustrated leaflet dealing with factory bulkhead fittings and a new type of factory inspection hand lamp.

**Laidlaw, Drew & Co., Ltd.,** Gilmour Street, Simon Square, Edinburgh.—A pamphlet entitled "Warmth Without Work," describing the company's fully automatic oil-firing set.

**Redfern's Rubber Works, Ltd.,** Hyde, near Manchester.—List No. A.438, dealing with mechanical and general rubber goods.

**British Thomson-Houston Co., Ltd.,** Rugby.—Descriptive lists Nos. 5614-1 and 5655-1 on a.c. direct-on contactor starters and d.c. contactor starters respectively.

**Drayton Regulator & Instrument Co., Ltd.,** West Drayton, Middlesex.—List No. 172, dealing with pressure reducing valves of steam, air, and water.

**Revo Electric Co., Ltd.,** Britannia Works, Tividale, Tipton, Staffs.—The new season's catalogue of electric fans.

**J. J. Eastick & Sons,** 118, Bunhill Row, E.C.1.—The May "Eelex Radio Bulletin," together with an announcement of a number of special bargain offers.

**O'Brien & Hulme,** 73, George Street, Manchester.—A pamphlet on the new "Parafilm" insulating tape.

**Falk, Stadelmann & Co., Ltd.,** 83-93, Farringdon Road, E.C.1.—Several illustrated catalogues of glass and parchment lighting shades and bowls. Also catalogues Nos. 662 and P.1566 giving full particulars of "Antarctic" electric fans.

**Barton & Sons (1930), Ltd.,** Beehive Works, Green Street, Walsall.—Catalogue B.S. relating to steel conduits and fittings for lighting and power installations.

**Major Equipment Co., Ltd.,** 14, Palmer Street, S.W.1.—A 56-page catalogue, profusely illustrated in colour, of "Major" theatre and cinema lighting equipment. It is stoutly and attractively bound and contains an excellent index, together with particulars of some of the more important installations carried out recently by the company.

## Bankruptcy Proceedings

**B. Barnett,** electrical engineer, 2, Station Road, Manor Park, lately carrying on business at 317, Roman Road, Bow, as Maurice Engineering Company.—This debtor attended on June 8th at the London Bankruptcy Court for public examination upon accounts showing total liabilities of £2,564 (ranking £1,514) and assets "bad book debts £603." Upon the application of the Official Receiver the hearing was adjourned until June 29th.

**C. H. Garrett** (Hilton Garrett & Co.), dealer in electrical supplies, 128, Queen's Road, Brighton.—Last day for receiving proofs for dividend June 21st. Trustee, Mr. A. E. Orbell, 6 and 7, Old Steine, Brighton.

**A. J. Hodges,** electrical engineer, 4, Binswood Street, Leamington Spa.—Last day for receiving proofs for dividend June 21st. Trustee, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham.

**C. G. Smith,** electrical contractors, 66, Lichfield Street, Wolverhampton.—Last day for receiving proofs for dividend June 25th. Trustee, Mr. A. E. Lacon, 14, Lichfield Street, Wolverhampton.

**E. Brown** (World's Wireless Stores), 10 and 12, Grosvenor Parade, Wallington, Surrey.—First dividend of 4s. in the £, payable June 14th at the offices of Messrs. Griffin, Stone, Clark, Moscrop & Co., 60, Strand, W.C.

**N. G. Crews,** electrical engineer, 99, Clapham Road, Lowestoft.—Receiving order made June 7th on debtor's own petition. First meeting June 18th at the Official Receiver's office, 4, Eastbourne Place, Prince of Wales Road, Norwich. Public examination June 27th at the Town Hall, Great Yarmouth.

**A. C. E. Applin** (Applin & Burt), electrical engineer, 110, St. Mary's Road, Southampton.—Trustee, Mr. F. H. Langmaid, Midland Bank Chambers, High Street, Southampton, Official Receiver, released May 30th.

**J. Barber,** wireless dealer, 38, Shoobridge Street, Leek.—Last day for receiving proofs for dividend June 27th. Trustee, Mr. P. M. Milward, 12, Lonsdale Street, Stoke-upon-Trent, Official Receiver.

## Company Liquidations

**Bullphone, Ltd.,** radio and electrical manufacturers, New North Road, Barkingside, Essex.—The statutory meeting of creditors was held on June 8th, at Winchester House, E.C., Mr. W. Bullen, a director, occupying the chair. An approximate statement of affairs was submitted, which showed assets estimated to realise £2,226, from which had to be deducted £70 for preferential claims, leaving a balance of £2,155 to meet claims on debentures totalling £3,254. There was a deficiency as regarded the debentures of £1,098, and there were no assets available for the unsecured creditors. The ranking liabilities were set down at £6,894. The issued capital of the company was £1,000, all of which was fully paid, and as regarded the shareholders there was a deficiency of £7,894. That deficiency was attributed to: Excess of liabilities on March 31st last, £3,818; net loss on trading from April 1st last, £298; and written off assets in statement of affairs, £3,777. A representative of the London Electric Wire Co., Ltd., proposed that the company should be wound up compulsorily, and the motion was carried.

**Devereux, Ltd.**—Meetings July 7th at the offices of Messrs. Roach Williams & Co., 4, Copthall Buildings, E.C.

## Meeting of Creditors

**W. H. Johnson** (trading as "British Altavox Radio & Electric Co."), 22, Union Street, Kingston-on-Thames.—A meeting of creditors was held on June 2nd at the offices of Messrs. Haynes and Baker, 93, Mortimer Street, W.1, when Mr. Fulshaw Baker submitted a statement of affairs which disclosed liabilities of £2.686, of which £1,510 was due to the trade; there were loan creditors for £750, and private and guaranteed creditors amounting to £426. The total assets amounted to £1,518, leaving a deficiency of £1,168. The debtor attributed his present position to the failure of another company for which he made radio sets not being able to take them up. The principal creditors were not satisfied with the position, and informed the meeting that it was their intention to have the matter dealt with in bankruptcy. Although several of the other creditors were in favour of the estate being administered under a deed of assignment, no resolutions were passed, and the meeting terminated.

## Private Arrangements

**E. Hanson** (trading as Aigburth Radio Stores), 313, Aigburth Road, Liverpool.—At a recent creditors' meeting a resolution was passed in favour of the execution of a deed of assignment to Mr. J. Airey, of Liverpool, as trustee.

**J. G. Amps** (trading as "Amps"), wireless and electrical dealer, 30, High Street, Camberley.—A meeting of creditors was held recently at the offices of Messrs. Haynes and Baker, Mortimer Street, London, W., when a statement of affairs was submitted which disclosed liabilities of £1,401, of which £501 was due to the trade; there was a loan creditor for £110 and a bank overdraft for £772. There were also expense creditors amounting to £18. The assets were estimated to realise £490, from which had to be deducted £42 for preferential claims, leaving net assets of £448, or a deficiency of £953. Debtor attributed his position to his lack of experience in the class of business carried on. It was stated that a deed of assignment had been executed in favour of Mr. W. Fulshaw Baker, as trustee, and the creditors decided to confirm that appointment, together with a committee of inspection.

**A. E. Webster** (trading as the London Electrical Co.), 1, Sherborne Lane, E.C.3, 23, College Hill, Cannon Street, E.C., and 35, Arch, Great Suffolk Street, S.E.—A circular, dated June 8th, has been issued to the creditors by Mr. W. H. Cork, of Messrs. W. H. Cork & Co., 19, Eastcheap, E.C., requesting their attendance at a meeting which will be held at the Cannon Street Hotel to-day (Friday).

# Electricity Supply

## Lighting, Domestic, Power

**Accrington.**—SUPPLY IMPROVEMENT.—The Electricity Committee is to improve the supply at Huncoat at a cost of £2,022.

**Ashford (Kent).**—STREET LIGHTING.—The East Ashford Rural District Council has accepted the offer of the Urban District Council for street lighting at Willesborough.

**Ashton-under-Lyne.** — CONVERSION OF STREET LIGHTING.—Four hundred and fifty time switches are to be purchased by the Market & Lighting Committee in connection with the conversion of street lamps from gas to electricity.

**Barrow-in-Furness.** — EXTENSIONS. — The Electricity Committee is to give supplies of electricity to Scales at a cost of £895, and to Swarthmoor and Pennington at a cost of £700.

LIGHTING OF NEW PUBLIC HALL.—Electric lighting is to be installed at the new public hall at a cost of £358.

**Birmingham.**—FIRE HIRING SCHEME.—The Corporation has commenced to hire out an imitation coal fire at 3s. per quarter. The fire can also be purchased by twelve quarterly payments of 5s. 9d. Small articles such as kettles and irons are also being supplied on hire-purchase terms, spread over four quarters.

**Bristol.**—PREPARATIONS FOR GRID CONNECTION.—The Electricity Committee recommends the installation of additional switchgear and protective gear costing £58,000 in anticipation of the connecting-up of the city's supply system with the grid.

TRANSFORMERS AND SWITCHGEAR.—Additional transformer and switchgear equipment is to be provided at the Avonmouth Dock at a cost of £1,200.

**Buckie.**—CONCESSION TO CONSUMERS.—The Town Council has decided to allow a discount of 2s. 6d. in the £ on consumers' accounts, inclusive of minimum charges.

**Burton-on-Trent.**—EXTENSIONS.—The Electricity Committee is to provide supplies of electricity to Bretby at a cost of £793 and to Hanbury at a cost of £636.

**Cardiff.**—PRICE REDUCTIONS.—The Electricity Committee has made reductions which amount to £1,084 per annum for traction, £780 for street lighting, and £825 for lighting (maximum demand rate).

GRID SWITCHGEAR.—Switchgear work is to be carried out in connection with the grid at an estimated cost of £15,580, and tenders are to be invited.

MAINS EXTENSIONS.—Mains extensions to housing estates are to be undertaken at a cost of £900.

**Carlisle.**—MAINS EXTENSIONS.—The Electricity Committee is to extend electricity mains in several areas at a cost of about £5,000.

**Chesterfield.**—CHEAPER ELECTRICITY.—The Electricity Committee recommends the following reductions in charges: Ordinary private lighting: To 3¾d. per kWh. Standing charge of domestic all-in rate: From 40s. to 35s. per 100 kWh used for lighting. Standing charge for large power consumers: From 9s. 2d. to 8s. 9d. per kVA per month.

**Colchester.**—REQUESTS FOR SUPPLIES.—The City Council has received a petition from 71 residents for a supply of electricity to Wakes Colne and Chappel, and the district is to be canvassed.

**Dewsbury.**—EXTENSIONS.—The Town Council has decided to extend the supply of electricity in Headland Lane and Walker Street, Earlsheaton, at an estimated cost of £500.

**Eccles.**—LOAN.—The Electricity Committee is to apply for sanction to a loan of £5,478 for transformers, kiosks, and mains.

**Fareham.**—PUBLIC LIGHTING.—The Urban District Council has accepted the offer of the Portsmouth Electricity Committee for public lighting at Portchester.

**Faversham.**—BULK SUPPLY.—The Town Council has applied to the Kent Electric Power Co. for a partial bulk supply of electricity.

**Folkestone.**—PURCHASE OF UNDERTAKING.—The General Purposes Committee on June 2nd decided in favour of purchasing the undertaking of the Folkestone Electricity Supply Co., Ltd. The company's final offer included a reduction in the flat rate charge from 6d. to 5½d. per kWh, with a further reduction to 5d. after a year, or alternatively, a two-part tariff with a "unit" charge of 1d. to be reduced after a year to ½d., on an agreement covering forty-two years, with an option to purchase after twenty-five years. The Committee's decision will come before the Town Council for confirmation.

**Guildford.**—SUPPLY ALTERATIONS.—The Council has agreed to the adding of the parish of Godalming Rural to the area of the Mid Southern District Utility Co., who will apply for a Special Order to supply electricity there.

**Guisborough (Yorkshire).**—REQUESTS FOR SUPPLIES.—The Rural District Council has received applications for the extension of the electricity supply to Barnaby Moor and Dunsdale.

**Hendon.**—COUNCIL NOT TO PURCHASE UNDERTAKING.—The Urban District Council has decided not to exercise its option to purchase the undertaking of the Hendon Electric Supply

Co., Ltd., in June, 1933. The next opportunity to purchase is in 1946.

**Inchmichael.**—RESULT OF INQUIRY.—The result has been issued in the recent inquiry into the delay in electrification in the Carse of Gowrie, near Dundee. It will be recalled that there was an alleged failure of certain farmers to come to terms with the Grampian Electricity Co. The Ministry has now granted consent for the cable line to cross both East Inchmichael and South Inchmichael farms. The company will pay as rental for the wayleave in respect of the cable line an annual sum to be agreed upon by the company and the farmers. Failing agreement an arbitrator will be resorted to.

**Leyton.**—CHANGE-OVER.—The Electricity Department is to proceed at once with the change-over in the " Bakers' Arms " area.

**Manchester.**—PUBLIC LIGHTING.—Arrangements have been made for the public lighting of the Heaton Park and Victoria Avenue (East) Estates, Blackley.

**Northern Ireland.**—ELECTRICITY BOARD'S ACTIVITIES.—Omagh Urban District Council has decided to request the Electricity Board of Northern Ireland to take over the Council's electricity undertaking, on the terms set forth in a recent letter from the Ministry on the subject. The undertakings at Helen's Bay and Newry are also to be taken over by the Board shortly.

**Penrith.**—THE ELECTRICITY SCHEME.—The Mid-Cumberland Electricity Co. has informed the Rural District Council that it will begin to lay mains in the area in the coming autumn.

**Redcar.**—SUPPLY TO HOUSING ESTATES.—The Town Council has received sanction to a loan of £2,000 for extending the electricity supply to new housing estates.

**St. Helens.**—REDUCED CHARGES.—Reductions in the electricity tariff have been made, the lighting rate being now 3½d. per kWh instead of 4d. for long-hour consumers. The rate for prepayment meters is 4d., instead of 4½d., and concessions are also made in respect of the domestic and small power supply. During the past year there has been a decline in the industrial demand of about 1,500,000 kWh, but this has been offset by an increased demand for lighting and small power. Consumption for the night lighting of shop windows has also shown a gratifying increase.

**Scarborough.**—LOANS.—The Electricity Committee is to apply for sanction to loans of £10,000 for meters and £7,500 for the change-over of consumers' apparatus.

LIGHTING OF GARDENS.—The North Side Development Committee has obtained sanction to a loan of £3,608 for electric lighting in the gardens.

**Stalybridge.**—ELECTRICITY FOR DIGGLE VALLEY.—The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board has applied for sanction to a loan of £7,500 for extending the supply of electricity to Diggle Village.

**Stone (Staffs).**—CHEAPER ELECTRICITY.—The Urban District Council has reduced the charge, under the multi-part tariff, to 1½d. per kWh for the first 240 kWh. 1d. for the second 240 kWh, and ¾d. per kWh beyond. The tariffs are to be reviewed again in six months' time.

**Sutton Coldfield.**—SUPPLY TO MANEY HILL ESTATE.—The Electricity Committee is to provide a sub-station and mains at a cost of £4,270 to supply the Maney Hill Estate.

**Thorne Moorends (Yorks).**—ELECTRICITY BOYCOTT THREATENED.—A boycott is threatened by electricity consumers unless there is an immediate reduction in the price of electricity to householders who have prepayment meters. The present charge is 6½d. per kWh. The Electrical Distribution of Yorkshire, Ltd., is to receive a deputation.

**Tonbridge.**—REDUCTION IN ELECTRICITY CHARGES.—The Urban District Council has made the following reductions in charges:—Urban area: Lighting, from 4½d. to 4d. per kWh up to 5,000 kWh; and beyond, from 3½d. to 3d.; two-part tariff, rates of 1d. and ¾d. per kWh reduced to ¾d. and ½d. respectively; Outside area: Lighting, from 7d. to 6d. per kWh; heating and power, from 2d. to 1½d.; two-part tariff, from 1½d. to 1d.

**Uttoxeter.**—THE RATEABLE VALUE TARIFF.—The Urban District Council has altered the fixed charge under the rateable value system to 12s. per quarter.

SUPPLY TO MARCHINGTON AND ROCESTER.—A scheme to supply Marchington by an overhead line is to be proceeded with at a cost of between £300 and £400, and the engineer, Mr. McGregor, is to prepare a scheme to supply Rocester and district.

**Wolverhampton.**—SUPPLY TO RAILWAY PUMPING STATION.—The Electricity Committee has resolved to give a supply of electricity to the L.M.S. Railway Co., which has decided to convert steam pumping plant to electricity. The estimated cost is £558.

IMPROVEMENTS IN WHITMORE REANS AREA.—To improve the pressure in the Whitmore Reans area a further transforming point is to be provided at a cost of £1,600.

MAINS EXTENSIONS.—Extensions to mains costing £642 are to be carried out.

**Workington.**—NEW TARIFFS.—The Electricity Committee proposes to introduce various new tariffs for heating, cooking, and shop-window lighting.

**Worthing.**—ALTERATION OF TWO-PART TARIFF.—The Electricity Committee has decided that for houses of under £30 rateable value the two-part tariff should be altered to provide for a fixed charge of £3 per annum instead of the existing percentage on the rateable value.

LIGHTING OF NEW PUBLIC BUILDINGS.—Mr. C. Cowles Voysey, the architect, has been asked to design and obtain tenders for electric lighting fittings for the new public buildings at an estimated cost of £1,950.

YEAR'S WORKING.—The accounts of the Electricity Department for the past year show a net profit of £9,098.

**Wallsend-on-Tyne.**—CABLE EXTENSIONS.—The Town Council has approved a scheme by the Newcastle-upon-Tyne Electric Supply Co., Ltd., for the laying of a l.p. distribution cable on the Archer Street Estate.

**Walsall.**—SUPPLY IMPROVEMENTS.—The Electricity Supply Committee has prepared a scheme costing £9,350 for alterations to the e.h.p. ring main system and the modernisation of switchgear.

## The Falkirk Inquiry

AN official inquiry was held by the Electricity Commissioners last week at Falkirk into the application of the Town Council to extend its generating station by the installation of a 5,000-kW turbo-generator set. Sir John Brooke presided. The Corporation's application was opposed on grounds of national interest by the Central Electricity Board. Mr. T. M. Cooper, K.C., and Mr. W. A. Murray appeared for the Town Council, while the Central Electricity Board was represented by Mr. Graham Robertson, K.C., and Mr. McIntyre.

Sir John Brooke, in opening the inquiry, explained that the proposed extension of the Corporation generating station would cost approximately £20,000. The Town Council had been in negotiation for about three years with the Central Board concerning the electricity supply for the area, but negotiations had been broken off, and the application had then been made to the Electricity Commission.

Mr. Cooper, K.C., for the Town Council, said that Falkirk's generating costs, particularly the fuel costs, would challenge comparison with any other similar undertaking in the United Kingdom. An application had been made to the Central Electricity Board for a supply and if the Corporation had accepted the Board's original offer it would be in the position in 1950 of having wasted £25,000; the Board's offer condemned the Council to the frustration of its refuse disposal scheme. At the moment the Falkirk undertaking had no offer before it from any source whatever, and there was no available source of supply except by independent generation.

Mr. Robertson, K.C., for the Board, contended that under the provisions of the Electricity Supply Act, 1920, he was entitled to oppose the application by the Corporation. Sir John Brooke pointed out that the general conception of the 1926 Act was that the bulk supply should be given by the Board in the areas in which it was operating. It was the Commissioners' duty before granting any extension to satisfy themselves that there was no satisfactory alternative bulk supply.

Mr. T. M. Climie, borough electrical engineer, said that the additional plant was necessary to meet the growing demands for electricity and he could look forward to developing the load substantially within the next few years, particularly on the domestic side. He admitted that in 1931 there had been a fall of 100 kW in the demand, but that was accounted for by the prevailing trade depression.

Provost Logan stated that the attitude of the Town Council had definitely been that it was preferable to continue to use its own station. Immediately the Board could convince him that it was prepared to give him a bargain, he would consider it.

Mr. Arthur Ellis, consulting engineer, gave evidence for the applicants, and said that, had the costs of other stations been as low as the cost at Falkirk, the grid supply would never have been necessary. Mr. Harold Hobson, supply engineer to the Central Electricity Board, stated that the Board held the view that the granting of the Corporation's application would be contrary to the express policy of the Government as embodied in the Electricity Act of 1926, and would not only be prejudicial to the Central Scotland Scheme, but also to the ultimate interests of the Corporation itself. Mr. Hobson stated that he was now prepared to submit an offer to provide for the whole of Falkirk's requirements at £3 11s. per kW of maximum demand per annum, plus 0.13d. per kWh. It was proposed that the agreement should continue for some years, and thereafter from year to year until the Corporation required the Board to substitute its general tariff. It was the Board's desire to assist in the utilisation of refuse. In his opinion, the price offered would be lower than that at which the Corporation could produce electricity.

When the inquiry was resumed last Friday, Mr. T. M. Cooper, K.C., for the Corporation, informed the Commissioners that, after consultation, the Corporation could not accept the Board's new proposal, and a statement to this effect was made by Mr. Arthur Ellis,

The inquiry was then closed.

# Traction

**Accrington.**—YEAR'S WORKING.—There was a deficit of £4,626 on the Corporation's tramways last year. The whole of the tramway service has now been superseded by buses.

**Continental.**—FRANCE.—The Railway Division of the French Ministry of Public Works is stated to have prepared a ten years' plan for the electrification of about 2,000 miles of railway system. Included in the scheme are the Paris-Havre, Valenciennes-Hirson, Paris-Châlons, Paris-Dijon, and Paris-Le Mans lines.

Trams are to be scrapped in Cannes and the tramway company is to be given the monopoly of the transport by buses.

The French Railway Board has recommended the electrification of the main line between Basle, Strasbourg, Mulhausen, and Belfort in connection with a scheme for the construction of an Alsatian Rhine lateral canal for the utilisation of water power. The proposal is said to be in conjunction with the anticipated electrification of competitive lines on the Baden side of the frontier. Altogether, Alsace-Lorraine is aiming at converting 2,900 km. of line to electric traction.

RUSSIA.—*Modern Transport* states that, at the invitation of the Russian Ambassador and in association with the Trade Delegation of the U.S.S.R. in Great Britain, three officials of the London Underground Railways are now visiting Moscow to inquire into, and submit a preliminary report upon, the traffic problems of that city, with special reference to the construction of a proposed system of underground railways in Moscow. The party comprises Mr. E. T. Brook (superintendent of rolling stock), Mr. Evan Evans (assistant superintendent of the line), and Mr. J. C. Martin (assistant to Mr. H. Dalrymple-Hay, consulting engineer), who has recently been employed as the resident engineer on the first section of the Southgate extension of the Piccadilly line, now nearing completion.

**L.M.S. Railway.**—COLOUR LIGHT SIGNALLING.—The first section of the L.M.S. new system of automatic colour light signalling was put into operation this week between Hatch End and Willesden. When this is completed a greatly augmented service will be possible on the Watford electrified section of the railway.

**London.**—MORE TRAFFIC LIGHTS.—A scheme drawn up by the Ministry of Transport and the Metropolitan Police and submitted to the Traffic Advisory Committee provides for the installation of traffic signals at 150 traffic junctions in London. Among the first places at which it is proposed to introduce automatic control are Trafalgar Square, Piccadilly, Hobart Place, Eccleston Square and Albert Gate. At these points alone thirty constables are now employed and it is estimated that with traffic signals ten would suffice, thereby saving approximately £6,000 a year. Since the signals were installed in Oxford Street the speed of the traffic there has increased from five to twelve m.p.h.

**Southend-on-Sea.**—TROLLEY-BUSES TO REPLACE TRAMS.—The Light Railways and Tramways Committee is considering the substitution of trolley-buses for trams on certain routes in the borough.

**Wallasey.**—TRAMWAY ABANDONMENT.—The Corporation is to consider the abandonment of the Pake Lane tramways and the extension of motor-bus services to Saughall Massis.

**Walsall.**—TRAMWAY ABANDONMENT PROPOSAL.—The Town Council has approved a proposal to abolish its one remaining tram service between Walsall and Bloxwich, to pay off the outstanding debt on the trams of £14,000, and to substitute a trolley-bus system. The provision of the buses, it is understood, will cost £30,000, and the total scheme is estimated to cost £46,505.

**Wolverhampton.**—YEAR'S WORKING.—The Transport Committee's report for the past year shows a gross profit of £88,634 and a net profit of £8,312. During the last seven years the debt on the superseded tramways has been liquidated. The number of passengers carried on trolley-buses was 25,956,916. A through trolley-bus service has been running to Walsall since last November.

# Communications

**Argentina.**—NEW HIGH-POWER BROADCASTING STATION.—Technical arrangements have now been completed for the erection of the new high-power "Radio Excelsior" broadcasting station (L.R.5) near Buenos Aires. The new transmitter, which will replace the existing one, is being manufactured at the Marconi works, and it is expected that regular service from the station will commence early next year. It will have 20-kW unmodulated aerial carrier energy with modulation up to 100 per cent., adjustable to any wavelength between 200 and 545 metres (1,500 to 550 kilocycles), the working wavelength being 361.4 metres (830 kilocycles). A quartz crystal master-control oscillator is to be provided, followed by a harmonic selector and a radio-frequency amplifier and isolator stage, coupled to a two-stage radio-frequency amplifier. The latter will be modulated by a two-stage acoustic-frequency amplifier, which will magnify the microphone current sent along the land line from the studio. The modulated radio-frequency will then be further amplified by two power-amplifier stages, using water-cooled valves, the final stage being fitted with six of these valves. The high voltage for the anodes of the valves is to be obtained by direct rectification of three-phase power by means of water-cooled thermionic valves. A half-wave aerial suspended between two 210-metre towers will be used with masts at a distance from the transmitting building, and the energy from the transmitter will be conveyed to the base of the aerial by means of a two-wire transmission line terminating in a feeder house underneath the aerial.

7,000-MILE CONVERSATIONS.—A party of Argentine students at present visiting this country were received at Electra House, Moorgate, last week and inspected the instrument rooms of Imperial and International Communications, Ltd., and witnessed a demonstration of cable working between London and the offices of the Western Telegraph Co. at Buenos Aires. Communication took place over the second longest cable in the world across 7,000 miles of intervening ocean bed, the signals being automatically relayed at Madeira, St. Vincent, and Ascension. Communication between London and Argentina has been speeded up by means of a new method known as the uneven channelling system, and by the installation of the regenerator system, which has ensured immediate and instantaneous transmission of signals between London and Buenos Aires. The regenerator system has also been applied to the cable routes between London and Montreal, Adelaide, Hong Kong, Singapore, and Capetown respectively.

The students also inspected the beam wireless circuits in connection with the "Empiradio" services to Canada, India, Australia, and South Africa, together with the high-speed wireless services to the United States and South America.

**Falkirk.**—SCOTTISH REGIONAL TRANSMITTER.—The full Scottish Regional programme was transferred to the new B.B.C. station at Westerglen, Falkirk, on June 12th, when the old transmitters at Edinburgh, Glasgow, and Dundee were withdrawn. The new transmitter has been radiating reception-test transmissions since May 2nd. The National programme transmitter at the Scottish Regional station will work on a wavelength of 288.5 metres. It will be introduced gradually, and reception-test transmissions will start in a few weeks.

**London.**—TELEPHONE AND TELEGRAPH FINANCE.—The Postmaster-General announced in the House of Commons last week that in 1931-32 the telephone service had a surplus of £557,000, but there was a loss of £828,000 on the telegraph service. The latter deficit is to be reduced this year by £180,000.

OVERHEAD LINE CONTROL.—The L.C.C. Public Control Committee proposes to promote legislation to secure powers for the control of overhead wires, new powers being necessary in view of the introduction of wireless relay systems.

**Pinner.**—NEW TELEPHONE EXCHANGE.—A new manual telephone exchange at Pinner in Marsh Road, the equipment of which was manufactured and installed by Standard Telephones and Cables, Ltd., was brought into operation by the General Post Office on June 8th. The equipment is for 3,340 lines, and extensions to provide ultimately for 9,500 subscribers are contemplated.

**Spain.**—BROADCASTING PLAN.—The Government is prepared to consider offers from private sources for the establishment of a broadcasting system, one of the conditions being that eight transmitters must be established, says *World-Radio*, at the following places: Madrid, a station of 120 kW with a wavelength of between 1,333.3 and 1,395.3 metres, one of 20 kW, wavelength 424 metres, and a short-wave station of 10 kW; in Barcelona, a station of 20 kW, wavelength 368 metres; in Valencia, a station of 20 kW, wavelength 349 metres; in Seville, a station of 20 kW, wavelength 263 metres; in Corunna, a station of 20 kW, wavelength 251 metres; and in Bilbao, a station of 10 kW, wavelength 229 metres.

**Switzerland.**—BROADCASTING UNION.—The International Broadcasting Union held its summer meeting at Montreux last week. Vice-Admiral C. D. Carpendale, C.B. (Great Britain), who received a knighthood in the recent Birthday Honours List, was re-elected president for 1932-33, his seventh term of office. Among those present were the representatives of sixteen European broadcasting organisations, ten European postal administrations, the European directors of the two principal chains of broadcasting stations in the United States, two delegates of the U.S.S.R., the director of the International Bureau of the Telegraphic Union at Berne, and a representative of the Section of Communications and Transit of the League of Nations. It was announced that the number of licences in Europe alone had increased by more than two millions between March 31st, 1931, and March 31st, 1932.

Recent research having shown that the over-modulation of a transmitter may give rise to serious interference with other stations working on neighbouring wavelengths, the Union decided to install in its checking station in Brussels (in addition to the equipment used for the last five years in the nightly observation of the stability of the wavelengths of European stations) a new recording apparatus which will register any tendency towards over-modulation. The next meeting of the Union will take place in Geneva as soon as possible after the International Radiotelegraphic Convention at Madrid in the autumn, in order to submit without delay to the European administrations—whom the Union Internationale de Radiodiffusion serves as an expert adviser on broadcasting matters—such proposals as will be capable of deriving the greatest possible advantage for European listeners from the new conditions resulting from the Madrid Convention.

# Contract Information

*When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below*

## Contracts Open

**Australia.**—SYDNEY.—October 17th. City Council. Four three-circuit power transformers for Pyrmont power station. Construction engineer, Electricity Department (deposit £1 plus sales tax).

**Carlisle.**—PUBLIC ASSISTANCE COMMITTEE.—Radio equipment at the Fusehill Institution. Public assistance officer, 7, Victoria Place, Carlisle.

**Egypt.**—CAIRO.—June 25th. State Domains Administration. Wire for use with power presses. (G.X. 11535.)*

**Glasgow.**—June 24th. Corporation. Water-tube boiler mountings, mechanical stokers, grit arrester and economiser for new baths and washhouse. Office of Public Works, City Chambers, (fee £2 2s.).

June 22nd. Education Department. Electrical work at St. Thomas's (new) School, Riddrie. Education Officer (Property Department), 129, Bath Street (deposit £1 1s.).

June 23rd. Cleansing Department. Switch panels, transformer and cables. Director of cleansing, 20, Trongate.

**Halifax.**—June 18th. Corporation. Electricians' work at Children's Home, Westfield. Mr. D. T. Lloyd Jones, borough engineer, Crossley Street.

June 20th. Electricians' work at ten small bungalows, Sandhall Green. Mr. D. T. Lloyd Jones (deposit £1 1s.).

**Horsham.**—June 27th. Electricity Department. Construction and erection of e.h.p. overhead line. (June 3rd.)

**Hull.**—June 21st. Electricity Department. Electrically driven capstan. Mr. J. N. Waite, city electrical engineer and manager, Electricity Works, Sculcoates Lane, Hull.

**India.**—SIMLA.—July 11th. India Stores Department. 31,000 "S-type" inert cells. Director-General, India Stores Department, Belvedere Road, S.E. 1 (fee 5s.).

**Leeds.**—June 24th. Public Assistance Committee. Electricians' work in connection with the conversion of Woodhouse Lane police station into a public assistance relief station. Mr. H. Fieldhouse, public assistance officer, 11, South Parade.

**Manchester.**—June 20th. Electricity Department. One 6,000-kVA static transformer. (June 3rd.)

June 27th. Automatic, booster transformers, voltage-variation equipments for 6,600-V transformers. (June 10th.)

**Meltham.**—July 1st. Urban District Council. Wiring for lighting installation in 120 Council houses at Broadlands. Mr. T. S. Hayton, U.D.C. clerk, Town Hall, Meltham.

**Menston.**—June 20th. West Riding Mental Hospitals Board. Electric lighting installation in part of the Menston Mental Hospital. Mr. W. E. H. Burton, architect and engineer to the Board, Wakefield (deposit £1).

**Morley.**—June 25th. Education Committee. Electric motors, &c., for new textile department at the Technical Institute. Mr. H. Bolan, secretary for technical education, Town Hall.

**Nottingham.**—June 21st. Electricity Department. General stores. (June 3rd.)

**Oswestry.**—June 20th. Electricity Department. Electrical stores, cables, meters, oils, washed slack, engine room stores, &c. (June 10th.)

**Portsmouth.**—June 18th. Electricity Department. Switchgear and kiosk sub-stations. (June 10th.)

**Swansea.**—August 3rd. Electricity Department. Generating plant for Tir John North power station. (See this issue.)

**Uruguay.**—MONTEVIDEO.—July 25th. State Electricity Supply and Telephone Administration. Ten transformer sub-station switchgear equipments. (A.X. 11359.)*

**West Riding.**—June 27th. County Council. Electric lighting installation at Drake & Tonsons Girls' New Grammar School, Keighley. Education officer, County Hall, Wakefield.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

## Contracts Closed

**Angus.**—County Council. Accepted. Electric lighting installation at housing scheme (£231).—D. J. Macdonald.

**Barrow-in-Furness.** — Electricity Committee. Accepted. Twenty-four motors in connection with change-over in Salthouse area.—Contract to be divided between the British Thomson-Houston Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., and Crompton Parkinson, Ltd. Six feeder pillars (£305).—W. T. Henley's Telegraph Works Co., Ltd. Forty 4-way boxes (£300).—Siemens Bros. & Co., Ltd. Four boxes (£41).—British Insulated Cables, Ltd.

**Cardiff.**—Public Works Committee. Accepted. Two electric motor pumps (£940).—Drysdale, Ltd.

**Carlisle.**—Electricity Committee. Accepted. Cable for twelve months.—Macintosh Cable Co., Ltd.; British Insulated Cables, Ltd.; Metropolitan Electric Cable and Construction Co., Ltd. Transformers. Four 30-kVA transformers (£50 each), and two 200-kVA transformers (£105 each).—Bruce, Peebles & Co., Ltd. One 200-kVA transformer (£117).—Johnson & Phillips, Ltd.

**Chesterfield.**—Town Council. Accepted. 11,000-V truck-type switchgear (£202).—Metropolitan-Vickers Electrical Co., Ltd. Kiosk sub-station (£282).—British Thomson-Houston Co., Ltd. E.h.p. and l.p. cables (£824).—Derby Cables, Ltd.

Corporation Gas Committee. Recommended. Electric gas booster at Provan gas works (£3,534).—British Thomson-Houston Co., Ltd.

**Dover.**—Town Council. Accepted. Cables (£1,264).—Pirelli-General Cable Works, Ltd.

**East Ham.**—Electricity Committee. Recommended. Rubber-insulated cables.—General Electric Co., Ltd.; Liverpool Electric Cable Co., Ltd. House service boxes, cut-outs, &c.—W. T. Henley's Telegraph Works Co., Ltd. Switch panels (£421).—A. Reyrolle, Ltd.

**Glasgow.**—Education Committee. Recommended. Electrical work at Riverside school (£636).—T. B. & J. A. Mathieson, Ltd.

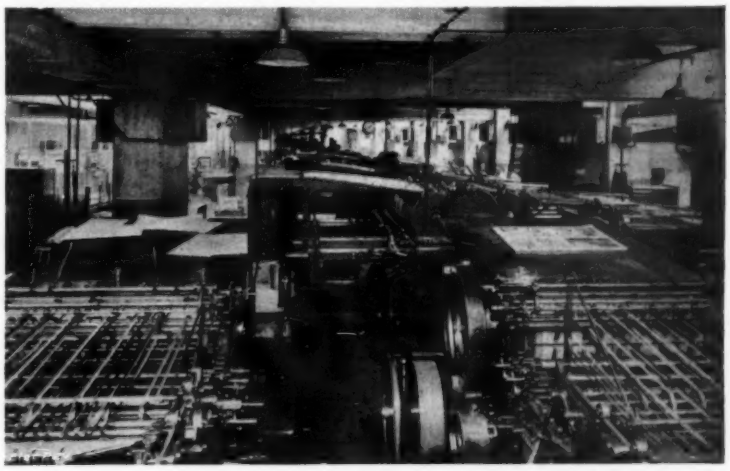
Corporation. Housing Committee. Accepted. Electrical fittings and cables.—Wm. McGeoch & Co., Ltd.

**Grimsby.**—Corporation Electricity Committee. Accepted. H.p. cables.—Metropolitan Electric Cable & Construction Co., Ltd. (£1,522); Johnson & Phillips (£1,344).

**London.**—City Sanitary Committee. Recommended. Electrical installation at Denton Hospital (£298).—Electrical Installations, Ltd.

**Manchester.**—Education Committee. Accepted. Electrical installation at Mill Street meals centre.—R. Seddon & Sons. Electrical installation at Ancoats nursery school.—John Collier & Co. (Electrical Engineers), Ltd.

**Morecambe.**—Electricity Committee. Accepted. Switchgear installation at Torrisholme sub-station.—Crompton Parkinson.



**Electricity in printing: The machine room of the Cornwall Press, Ltd.**

**Rugby.**—Urban District Council. Accepted. Cable.—Derby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.

**Walsall.**—Electricity Committee. Recommended. Two 300-kVA transformers (£250).—Brush Electrical Engineering Co., Ltd. 14 new e.h.p. switch units (£3,573), and 70 replacer circuit breakers (£3,718).—Ferguson, Pailin, Ltd.

**Wolverhampton.**—Electricity Committee. Accepted. Main equipment (£188).—Ferguson, Pailin, Ltd. Transformer (£152).—Electric Construction Co., Ltd.

## Forthcoming Events

**Institution of Heating and Ventilating Engineers.**—June 20th-22nd. Folkestone. Summer meeting.

**Municipal Tramways and Transport Association.**—June 22nd-24th. Eastbourne. Annual conference.

**Illuminating Engineering Society.**—Friday, June 17th. Royal Society of Arts, London. 7 p.m. Annual general meeting. Presidential address. Sir Francis Goodenough.

**Association of Mining Electrical Engineers.**—June 20th-24th. Glasgow. Annual convention.

**Municipal Tramways and Transport Association, Inc.**—June 22nd-24th. Grand Hotel, Eastbourne. Annual conference.

**Electrical Contractors' Association.**—June 28th-30th. Southport. Annual conference.

**Institution of Electrical Engineers.**—Wednesday, June 22nd. Institution, London. 8.30 p.m. Conversazione of Overseas members. Thursday, June 30th. Natural History Museum, Cromwell Road, S.W. 8.30 p.m. Conversazione.

**Overhead Lines Association.**—July 1st. Chesham. Summer meeting.

## Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the name and address of the makers of the following:—

SPIROVANE electric pumps.
LINK soldering apparatus.

# Notes

### Generation of Electricity, May, 1932

The official returns rendered to the Electricity Commissioners show that 895 million kWh was generated by authorised undertakings in Great Britain during the month of May, 1932, an increase of 11.6 per cent. as compared with the revised figure of 802 million kWh in the corresponding month of 1931.

During the first five months of 1932 up to the end of May the total amount of electricity generated by authorised undertakings was 5,267 million kWh, representing an increase of 8.3 per cent. as compared with the revised figure of 4,863 million kWh for the corresponding period of 1931.

### Metal Research for Industry

From the twelfth annual report of the British Non-Ferrous Metals Research Association it is encouraging to note that, despite the intense industrial depression, the Association has received in subscriptions from its members a larger sum than in any previous year. The new headquarters in London contains a model information bureau, research laboratories, and the development section with its exhibition of some of the Association's research results, which serves as a stimulus to their application by industry. The growth of the Association in recent years has been remarkable, but from the report it is obvious that great difficulties are still met with in financing the research and other work which has been planned. In spite of the large field of industry which is covered the present membership is only 200. Among new materials which have been made available to industry by the Association's researches new ternary alloys for cable sheathing and aluminium brass condenser tubes are of outstanding importance. The practical nature of the work is indicated by the researches it has in hand on such subjects as the effect on health of the use of aluminium cooking vessels, bearing metals, the tarnishing of metals, and the inquiries which it is undertaking for its members on the improvement of the efficiency of industrial production. At the annual meeting of the Association on June 7th, addresses were given by Sir Auckland Geddes, Sir Frank Smith, F.R.S., and Mr. T. Bolton. The scale of the Association's work has grown considerably in recent years and its income now exceeds £25,000. Tangible results of direct commercial application are now being secured and the Association appeals for a larger membership and greater financial support. Apart from its twenty-three major researches, the Association's staff affords service to its members in many directions.

### Appointments Vacant

Showroom superintendent for Barnsley Electricity Department.

Assistant general manager and deputy engineer for Poplar Electricity Department.

Professor of electrical engineering for Manchester Municipal College of Technology.

(See our advertisement pages to-day.)

### British Standard Screws

The British Standards Institution has already issued standards for British Standard Whitworth (B.S.W.), British Standard Fine (B.S.F.) and British Association (B.A.) threads. Bolts and nuts made with these threads are principally covered by Specifications Nos. B.S.S. No. 190, 191, 193, 325 and 28. This list has been extended to provide for bright countersunk round and cheese-head screws from ¼ to 1 in., and bright square head set-screws from ¼ to 1 in. Copies of these specifications (No. 450 and 451-1932) may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d. each, post free.

### Public Lighting

The work of a public lighting department is described in the paper which Mr. E. Marrison read recently at a joint meeting of the Illuminating Engineering Society and the Association of Public Lighting Engineers.

Particular reference is made to the City of Sheffield's organisation, for which the Corporation voted £65,000 last financial year. In spite of the increasing importance of street lighting, the author complains that the amount voted for its upkeep is usually not generous.

The Department has built new premises, costing £15,500, including workshops and test rooms. Of the total expenditure, gas accounted for 27.1, and electricity for 14.6 per cent., including lamp maintenance. Mechanical control is found to be cheaper than hand control, and has other advantages. Of 4,505 electric lamps in use, only 121 are hand controlled; and of 15,808 gas lamps, 2,966 are manual. The electric lighting in main thoroughfares and on new housing estates is controlled by time switches. Given proper attention the efficiency of clock controllers has been found very satisfactory; on the average there is only one failure in 600 operations.

### Fusion Temperature of Coal Ash

There is some connection between the fusion point of coal ash and the tendency to clinker, but there is little reliable data establishing the relation from the laboratory test and the furnace. A definite step forward has been made in the correlation of the fusion temperature of coal ash with practical furnace conditions in the issue by the British Standards Institution of a standard method for the determination of the fusion temperature of coal ash. The method consists in observing, by means of an optical pyrometer, the temperature at which deformation occurs on heating triangular cones. A button may also be used, but observation of the fusion point may be more difficult than with a cone. A suitable size of button is ¼ in. in diameter and ¼ in. high. The method allows the determination of fusion temperature to be made in either an oxidising or a reducing atmosphere, the result in the latter case, being invariably the lower if the ash contains iron. Copies of this specification (B.S.S. No. 453, 1932) may be obtained from the British Standards Institution, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

### Telephone Mouthpiece Sterilisation

With a view to obviating risk of infection to those using a telephone the Hygiephone Company has introduced a device consisting of a number of capsules pressed together in the form of a nest and impregnated with disinfectant. The nest is placed in the mouthpiece and retained there by a rim-holder. We understand that the claims for the efficacy of the antiseptic are supported by tests carried out by a well-known bacteriologist and analyst to several public authorities. More unexpected is the testimony of Dr. E. Mallett, M.I.E.E., who finds that the device actually improves the output of the new hand microphone and makes no difference that is appreciable with the ordinary "candle-stick" telephone.

# The B.B.C. Report

THE fifth annual report of the British Broadcasting Corporation shows that the number of listeners' licences increased in 1931 by 918,825 to a total of 4,330,735, including those issued free to blind listeners, which increased by 9,521 to 28,981. The total transmitting time was about 63,500 hours, and the percentage of breakdown time was 0.028; these reductions were due to the replacement of seven small transmitters by two high-power transmitters.

The new headquarters in London have been completed, and the regional studios and control rooms are being modernised.

**Broadcasting House, London**

The new North and Scottish Regional transmitters have been completed, the construction of the West Regional station has been begun, the Midland Regional transmitter is to be reconstructed, and the Daventry (5XX) long-wave national plant is to be rebuilt and its power increased.

The two Empire short-wave transmitters, capable of working on a number of wavelengths, are to be ready by the end of this year. In co-operation with Marconi's Wireless Telegraph Co., Ltd., a transmitter with a wave band from 6.5 to 8 metres is to be installed at Broadcasting House, London, for experimental purposes.

Amelioration of wavelength interference is unlikely to be attempted until after the International Radio-Telegraph Convention is held at Madrid from September to November, 1932. The B.B.C. has continued its active membership of the Union Internationale de Radiodiffusion.

International relaying has been consolidated rather than extended, and at home the interlinking of transmitters by underground cables is being continued. New high-quality cables are being leased from the G.P.O. to take the place of the overhead circuits used since 1923. Research is being continued into studio acoustics, volume control and measuring instruments, the design of microphones and amplifiers, and transmitter aerials and field strength.

The capital expenditure during the year amounted to £907,371. A loan of £500,000 in respect of Broadcasting House is repayable by annual instalments of £100,000, beginning this year, and £253,019 remains available for future capital development. The net revenue exceeded that of the previous year by £200,995. In 1932 the Corporation will receive rather less than 5s. out of each licence fee paid.

Progress in school broadcasting was somewhat retarded by the financial crisis, but 567 new schools were registered during the year, making a total of 3,555 schools in regular contact.

# Our Personal Column

**Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements**

**Mr. Samuel Insull**, whose resignation from various Insull utilities undertakings was referred to in our "City Notes" last week, is reported in Press dispatches to have lost his personal fortune of about £20,000,000 and to have personal obligations of £2,000,000, including several million dollars of bank loans. Three of the Insull boards have voted him pensions aggregating £3,600 per annum, but one paper remarks "this will not go far towards liquidating his £2,000,000 debts." Questioned by newspaper men, Mr. Insull, who is seventy-two years of age, is reported to have stated: "I have gone from the bottom to the top and I am now at the bottom again. I only hope I will be able to keep a roof over my head and care for my wife." The New York correspondent of the *Financial Times* reports that General Dawes has resigned the presidency of the Reconstruction Finance Corporation for the purpose of returning to Chicago to "straighten out the difficulties of the Insull group."

**Mr. L. McMaster** has been appointed secretary to the Electricity Board for Northern Ireland.

The Newcastle and District Electric Lighting Co., Ltd., held a smoking concert for the staff on June 10th at the Crown Hotel, Newcastle, under the chairmanship of Mr. N. S. Tennant, M.Sc., M.I.E.E., engineer and manager for the company, as a farewell to the deputy engineer and manager, **Mr. V. A. Pask,** M.I.E.E., A.M.I.Mech.E., on the occasion of his appointment as city electrical engineer to Norwich Corporation. On behalf of the directors, staff and employés, Mr. Tennant presented to Mr. Pask a silver tea service and tray. Mr. Pask will succeed Mr. F. M. Long, who is retiring at the end of the present month. Before joining the Newcastle company he had had electrical experience with the Paisley, Hull and Bootle electricity undertakings. He takes up his duties at Norwich on July 1st.

**Mr. V. A. Pask**

**Mr. A. H. B. Elley** has joined Messrs. J. H. Tucker and Co., Ltd., as district sales representative, and will look after their interests in the north-western area consisting of Lancashire, Westmorland and Cumberland. Mr. Elley has many years trade experience, having been connected with the Metro-Vick organisation, previous to which he was for a number of years associated with Messrs. Troughton and Young.

**Major H. Waymouth Prance,** chief engineer and contract manager of Radio Central Exchanges, Ltd., informs us that he is no longer associated with that company. His address is Garage Bungalow, Caroline Place, Bayswater, W.2.

**Mr. L. M. Barry,** manager of the Johannesburg Corporation tramways, has been elected president of the Association of Road Passenger Transport Officials of South Africa for the ensuing year.

**Mr. A. B. Stratford,** A.M.I.Mech.E., A.M.I.E.E., managing director of Stratford Engineering, Ltd., and of Crompton Parkinson (South Africa), Ltd., of Johannesburg, has arrived in England.

**Mr. J. M. Crawford,** who, as mentioned in our last issue, is to represent the Australian Government at the International Electrical Congress in Paris, has now arrived in London. Mr. Crawford is chief electrical engineer of the Australian Postal Department, and while in London he will confer with British Post Office officials regarding the latest developments in the electrical side of telephone work.

**Mr. C. O. Milton** has completed thirty years' service as engineer-in-charge of the municipal electricity undertaking at Maidenhead, and the Electricity Committee has placed on record its appreciation of his services.

**Mr. J. Cawley** has been appointed traffic superintendent to the Stockport Corporation tramways undertaking.

**Mr. J. J. Hyde** has been appointed Northern Ireland representative for Messrs. Switchgear & Cowans, Ltd. His address is 36, Bedford Street, Belfast.

## Obituary

**Major A. Brown.**—The death has occurred near Johannesburg of Major Andrew Brown, who was controller of telegraphs at Johannesburg from 1901 until his retirement in 1922. In 1904 he initiated and was commander of the Transvaal Signalling and Field Telegraph Corps. During the War he reorganised the Corps which then became the South African Signalling and Field Telegraph Corps.

**Mr. R. E. Bennett.**—The death occurred suddenly on June 5th, at the age of 56 years, of Mr. Robert Edward Bennett, chief electrician with Mr. P. Hodgkinson, of Devonshire Terrace, Bexhill-on-Sea. He had been associated with the business for thirty-two years.

**Mr. J. Bennett.**—The death has taken place whilst on a visit to his mother at Goole of Mr. John Bennett, of Rugby, who was on the staff of the English Electric Co., Ltd. He was 36 years of age, had been with the company since 1919, and for the last eight years had been engaged with the outside erection department.

**Mr. J. A. Carswell.**—The death occurred at his residence in Largs, Ayrshire, of Mr. James Archibald Carswell, Scottish manager of the Marconi International Marine Communication Co., Ltd. He was engaged in a match at Largs Bowling Green on Tuesday evening (June 7th) when he suffered a heart seizure. He was able to motor home and obtain medical attendance, but died in the early hours of Wednesday morning. A native of Glasgow, Mr. Carswell was 43 years of age.

**Prof. Ing. G. Ganassini.**—The death recently occurred in Milan of Prof. Ing. Galtano Ganassini, one of the leading authorities on hydro-electric installations in Italy. He was fifty-seven years of age.

**Prof. F. W. Meyer.**—The death recently occurred at the age of fifty-five years of Prof. Dr. Ing. F. W. Meyer, Professor at the Carolo Wilhelmina Technical High School at Brunswick, Germany. The deceased was for three years (1911-13) on the staff of the Westinghouse Co. at Pittsburgh, and later was engaged in research work at the Phœnix Physical Research Institute of the Columbia University, U.S.A. He was a leading German authority on electronics.

**Monsieur Arrighi de Casonova.**—The death is reported from Paris at the age of 53 years, of M. Jean-Antoine Arrighi de Casonova, the chief engineer of the Union de l'Electricité, of that city. Joining this concern in 1920, the deceased directed the extensions of the power station at Gennevilliers, and subsequently the reconstruction of the Vitry-Nord station, and finally, the recently completed power station hitherto known as Vitry-Sud, but which by decision of the directors of the Union is in future to be known as the Arrighi station as a memorial to the activities of the deceased engineer.

**Mr. P. Campbell.**—The death is reported of Mr. Percy Campbell at Gosforth, Newcastle-upon-Tyne, at the age of 57. He was chairman of Messrs. Gray Brothers, electrical engineers, Newcastle, and he was also connected with the Magneto and Battery Co. He was formerly mill manager of the Consett Iron Company, retiring from that position ten years ago.

## Railway Electrification in India. By Our Indian Correspondent

THE recently published report on the working of railways in India during the year 1930-31 gives a short summary of the progress of electrification and of the schemes proposed. So far as the G.I.P. Railway was concerned, 271 miles of 110-kV single-circuit transmission lines were sanctioned in full commission for supplying power to eleven sub-stations in the electrified section beyond Kalyan. Fifteen traction substations of a total capacity of 100,000 kW (normal rated output) are now in full commission, while four new sub-stations were put into service during the year. There are now 571 single-track miles of overhead equipment in service. New locomotives, numbering twenty-one, were put into operation and also forty-one electric freight locomotives. Power for the service is received from the Tata Hydro-electric Supply Co. and from the Railway's Kalyan power station.

Both on the G.I.P. system and on the B.B.C.I. system, defects in gear have been effectually remedied. The G.I.P. electrification offers an instructive example of the application of electric power to railway traction under varying conditions.

So far as the electrification of the South Indian Railway was concerned, it was not merely the conversion of existing steam-operated lines to electrical working but it included the construction of new tracks and stations to accommodate suburban traffic.

One of the chief difficulties encountered in laying out this electrification was the fact that there existed a number of small yards at some distance from the main line which could not conveniently be provided with overhead equipment. The problem was solved by providing, in addition to the locomotives, two tenders equipped with heavy duty batteries.

An investigation of the schemes for suburban railway electrification in Calcutta has shown that the electrification will not be financially successful unless the railway can deposit passengers nearer the business centres of Calcutta. In view of the difficulties in regard to the land required for this scheme and its high cost generally, it has been decided to re-examine the old proposal to connect the suburban systems of the E.I.R. and E.B.R. by means of a tube railway, and investigations are being carried out to ascertain whether a tube scheme is practicable from the engineering and traffic points of view.

# Financial Section

**New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares**

## New Companies Registered

**Hala (England), Ltd.**—Private company. Registered June 11th. Capital, £7,000 in 5,000 preference shares of £1 each and 20,000 ordinary shares of 2s. each. Objects: To acquire the business of sole distributors in Great Britain and Northern Ireland of the "Hala" ray apparatus lamps and vitalux bulbs; to manufacture and deal in high frequency and diathermy apparatus, vibrators, ultra-violet and violet ray apparatus, &c. The first directors are: W. T. Russell, "Rusrene," Wickham Court Road, Wickham, Kent; G. T. Melrose, 93, Richmond Road, Ilford; G. A. McCony, 28, Coram Street, Russell Square, W.C.1; and J. V. May, 23, Wessex Avenue, Merton Park, S.W. Registered office: Craven House, 121, Kingsway, W.C.2.

**Frank Deeling, Ltd.**—Private company. Registered June 9th. Capital, £2,000 in £1 shares (500 6 per cent. non-cumulative preference, 500 ordinary, and 1,000 deferred). Objects: To acquire the business of an electrical and radio engineer carried on by K. J. Clear, at 913, Brighton Road, Purley, Surrey, and to carry on the business of wholesale and retail electrical and wireless engineers, &c. The directors are: K. J. Clear, W. M. Clear, "Danbury," The Green, Ewell, and Mrs. C. Clear, 24, Florence Road, Sanderstead, Surrey. Secretary, Mrs. C. Clear. Registered office: 913, Brighton Road, Purley, Surrey.

**Perrins Brothers, Ltd.**—Private company. Registered June 13th. Capital, £1,000 in £1 shares. Objects: To acquire the business of Perrins & Co., carried on by P. Perrins and S. C. Perrins at 20, Broad Street, Teddington, and to carry on the business of manufacturers of, or dealers in, electric batteries, accumulators, electrical and radio goods and equipment, &c. The directors are: P. Perrins and S. C. Perrins, both of 51, Waldegrave Road, Teddington, Middlesex. Registered office: 20, Broad Street, Teddington, Middlesex.

**Finchley Electrical Co., Ltd.**—Private company. Registered June 11th. Capital, £100 in £1 shares. Objects: To acquire the business of a dealer in wireless and electrical goods, &c., carried on by A. J. Malsbury at 2a, Eton Parade, High Road, North Finchley. The directors are: A. J. Malsbury and Mrs. K. M. M. Malsbury, both of 35, Granville Road, North Finchley, N. Registered office: 2a, Eton Parade, High Road, North Finchley.

**Phillips & Sons Electrical, Ltd.**—Private company. Registered June 7th. Capital, £1,500 in £1 shares. Objects: To carry on the business of electrical, mechanical and general engineers, &c. The permanent directors are: H. Dubbury and Mrs. Gladys M. Dubbury, both of 1, Bowfell Road, Hammersmith, W.6. Registered office: 40, Waterford Road, Walham Green, S.W.6.

**Fort Radio, Ltd.**—Private company. Registered June 9th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric or mechanical appliances, &c. The directors are: R. V. Langbart and Elsie E. Langbart, both of 407, Lordship Lane, Tottenham, N.17. Registered office: 407, Lordship Lane, Tottenham, N.17.

## Returns of Electrical Companies

**Battery Services, Ltd.**—Capital, £500 in £1 shares. Return dated January 14th, 1932. 300 shares taken up. £300 paid. Mortgages and charges, nil.

**New Phonopore Telephone Co., Ltd.**—Capital, £10,000 in 9,000 ordinary and 1,000 founders' shares of £1 each. Return dated July 14th, 1932. 7,141 ordinary and 1,000 founders' shares taken up. £6,741 paid on 6,741 ordinary shares. £1,400 considered as paid on 400 ordinary and 1,000 founders' shares. Mortgages and charges, £2,666 13s. 4d.

**R. Pain & Sons, Ltd.**—Capital, £6,000 in £1 shares. Return dated August 28th, 1931 (filed February 16th, 1932). 4,304 shares taken up. £904 paid. £3,400 considered as paid. Mortgages and charges, nil.

**Darimont Electric Batteries, Ltd.**—Capital, £18,000 in 62,000 ordinary shares of 5s. and 50,000 deferred shares of 1s. each. Return dated December 28th, 1932. All shares taken up. £3,999 16s. paid on 34,666 ordinary shares and 6,666 deferred shares. £9,000 4s. considered as paid on 27,334 ordinary and 43,334 deferred shares. Mortgages and charges, nil.

**Nox Electric Lamp Co., Ltd.**—Capital, £15,000 in £1 shares. Return dated October 16th, 1931 (filed April 1st, 1932). All shares taken up. £14,500 paid. £500 considered as paid. Mortgages and charges, nil.

**Zelco, Ltd.**—M. Weiner, 53, Farringdon Street, E.C., was appointed receiver and manager on June 7th, under powers contained in debenture dated April 5th, 1932.

**Airedale Electrical & Manufacturing Co., Ltd.**—Satisfaction in full on September 18th, 1931, of deposit of deeds dated May 11th, 1927, and registered May 19th, 1927. Notice filed June 8th, 1932. (According to the register of mortgages, the only charge registered May 19th, 1927, was a mortgage which originally secured all moneys due to bank not exceeding £700.)

**Olympia Radio, Ltd.**—Debenture dated June 2nd, to secure £3,500, charged on the company's property, present and future, including uncalled capital (subject to prior debenture dated April 23rd, 1932). Holder: Mildred Kremner, The Quest, Okeover Road, Higher Broughton, Salford.

**Waldron Electrical Manufacturers, Ltd.**—Debenture dated June 2nd, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: G. C. Jeremiah, Redlands, Queen's Road, Sketty, Swansea.

**Whittaker Bros., Ltd.**—Capital, £7,000 in 1,000 cumulative preference, 5,000 "A" ordinary, and 1,000 "B" ordinary shares of £1 each. Return dated December 31st, 1931. 3,907 shares (class not stated) taken up. £3,207 paid. £700 considered as paid. Mortgages and charges, nil.

**Synchronome Co., Ltd.**—Capital, £7,000 in 5,000 2nd preference, 600 preference, and 1,400 ordinary shares of £1 each. Return dated October 13th, 1931 (filed March 31st, 1932). 4,200 2nd preference, 600 preference, and 1,400 ordinary shares taken up. £700 paid. £5,500 considered as paid. Mortgages and charges, nil.

**Montevideo Telephone Co., Ltd.**—Capital, £220,000 in £1 shares. Return dated November 6th, 1931. 217,135 shares taken up. £217,135 considered as paid. Mortgages and charges, nil.

**Barbados Electric Supply Corporation, Ltd.**—Capital, £60,000 in £1 shares. Return dated December 28th, 1931. All shares taken up. £38,051 paid. £21,949 considered as paid. Mortgages and charges: £16,000.

**R. E. Stichling, Ltd.**—Capital, £1,000 in £1 shares. Return dated December 28th, 1931. 1,000 shares taken up. £2 paid. £998 considered as paid. Mortgages and charges: £1,000.

**Baird Television, Ltd.**—Capital, £825,000 in 2,100,000 10 per cent. non-cumulative preferred ordinary and 1,200,000 deferred ordinary shares of 5s. each. Return dated January 13th, 1932. All shares taken up. £315,000 paid on 1,050,000 preferred ordinary (including premium of 1s. per share). £562,500 considered as paid on 1,050,000 preferred ordinary and 1,200,000 deferred ordinary shares. Mortgages and charges, nil.

**Bullphone, Ltd.**—V. L. Bell, 27 & 28, Old Jewry, E.C.2, was appointed receiver and manager on May 27th under powers contained in mortgage dated July 25th, 1929.

**Herbert Ward, Ltd.**—C. I. S. Chappell, 11, Queen Victoria Street, E.C.4, was appointed receiver on May 25th under powers contained in debenture dated May 31st, 1927.

**Magnetic & Electrical Alloys, Ltd.**—Charge on freehold land, factory and buildings at Wembley, dated June 1st, 1932, to secure £3,750. Holders: Fiat (England), Ltd., Western Avenue, Acton, W.3.

**Hedingham Radio, Ltd.**—Particulars filed of debentures for not more than 500, authorised May 24th, 1932, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £150.

**Electricity Distribution of North Wales and District, Ltd.**—Charge dated June 1st (supplemental to first mortgage debenture for £100,000 dated March 12th, 1926, and second mortgage debenture for £50,000 dated February 10th, 1927). Property charged: Various freehold and leasehold properties. Holder: The Treasury Solicitor.

**N.K. (Bradford), Ltd.**—R. G. Sidford, 76, Strand, W.C., ceased to act as receiver and manager on June 1st.

**A. W. Griffin & Co., Ltd.**—F. H. Pickering, 33, Newhall Street, Birmingham, was appointed receiver and manager on June 1st under powers contained in debenture dated August 21st, 1928. R. Custerton ceased to act in these capacities on May 13th, 1932.

## City Notes

**The Electric Supply Corporation, Ltd.,** reports gross earnings for 1931 of £88,379, as compared with £96,030 in 1930. The Hitchin undertaking was sold and receipts from that source were thus limited to the first six months of the year. The amount carried to net revenue account was £53,562 (£55,443). It is proposed to place £6,000 to repairs, renewals and depreciation fund and to pay a final ordinary dividend of 7 per cent., making 11 per cent., less tax, for the year (same), leaving £22,734 to be carried forward. Meeting: June 30th.

**The Brazilian Traction Light & Power Co., Ltd.,** reports a revenue from subsidiary companies of $9,791,293 for 1931, as compared with $16,407,899 in the preceding year. To this is added interest on investments and other income ($489,925), making $10,281,218. After providing for administration expenses and amortisation, there is a net revenue of $9,389,104 ($16,025,338), which is equivalent to $1.41 per ordinary share ($2.52). Two quarterly cash dividends of 25 cents per share and two stock dividends of one share for each fifty held have been paid on the ordinary shares, leaving a surplus revenue for the year of $2,077,191, which with $13,682,553 brought in makes $15,759,744 to go forward.

**The International Telephone & Telegraph Corporation** reports gross earnings for the quarter ended March 31st last of $19,035,933, as compared with $24,165,338 in the corresponding quarter of 1931. Operating expenses were $15,568,067, leaving net earnings of $3,467,866 ($5,307,971). The consolidated net income totalled $689,186 ($2,832,302), equivalent to $0.11 per share on 6,399,970 shares of capital stock (no par value) outstanding at March 31st last.

**The Croydon Cable Works, Ltd.,** proposes to convert into ordinary shares 35,000 seven per cent. cumulative preference, 25,000 seven per cent. cumulative record preference, and 14,100 six per cent. non-cumulative third preference shares, all of £1 each. The right to receive arrears of cumulative dividend is to be abrogated and abolished.

**Telephone Rentals, Ltd.**—The annual meeting was held on June 9th, Mr. F. T. Jackson (chairman) presiding. In presenting the report and accounts (ELEC. REV., June 10th, p. 865), the chairman said the year under review had been an extraordinarily difficult one, and they had had constantly to concentrate their attention on sales development in order to maintain their rentals at the figures at which they stood at the close of 1930. They had been more than successful in achieving this object, as during the year they had been able to increase their rent roll by approximately 4 per cent. This percentage was on the revenue taken to the credit of profit and loss account, not on contracts secured, and not executed at the date of the accounts. They had planned and put into operation the nucleus of an extensive sales development and service scheme, which would

be capable of extension when general trade became better, and which would be of great value in future years. The whole of the cost of this had been charged against revenue. In addition to this work they commenced a systematic overhaul of their old telephone installations with the object of bringing them up to date. This work would continue throughout the current year. The whole of this had also been charged against revenue, and this expenditure accounted for the fact that although the gross revenue for the past year was higher, the net profits were somewhat lower. This sales development was already bearing fruit. A substantial increase in contracts commenced in September of last year, and had continued right up to the present time. Their company in Australia had done better in 1931 than it did in 1930, and had made a small profit. Regarding the current year, up to the end of May they had been able to secure a larger number of new contracts than during the corresponding period of last year.

**The Electric Furnace Co., Ltd.,** reports a net profit of £9,306 for the year ended March 31st last, as compared with £4,400 in the preceding year, to which is added £1,179 brought in, making £10,486. The cumulative preferred ordinary dividend is paid, £3,000 is placed to general reserve, and £1,886 is carried forward. The report states that important technical progress has been made. Electric furnace installations having a total power of over 21,000 kW were on order at the end of the year. In the Sheffield district a new steel melting shop has been built and equipped with high frequency furnaces, while at the Ford motor works at Dagenham furnaces of more than 10,000 kW capacity are approaching completion. Many other interesting orders have been received during the year. Although business in France has been very depressed, important orders have been received from other countries, including one from India. The unsettled state of European countries renders foreign business extremely difficult, but advantage is being taken of the varying prosperity of the different industries and countries in which the company's products can be put to good use. Since the end of the financial year the volume of orders received and work in progress have been considerably in excess of those in similar periods during the last few years. Mr. G. E. Taylor, chief engineer, has been co-opted to the board. Meeting: June 22nd.

**The Central Electricity Board.**—On Monday last subscription lists were opened for £10,000,000 of 4½ per cent. stock, 1957-1982, at £96 per cent. The public response was such that the lists closed at 10.15 a.m. The proceeds will be used to provide further funds for the construction and acquisition of main transmission lines, the cost of standardisation of frequency, working capital, and other authorised purposes. The prospectus states that wayleaves have been obtained for 3,725 miles of the 4,000 miles (approximately) of overhead main transmission lines estimated to be the total mileage required for the Board's various schemes. Of these lines 2,770 miles have been constructed and 1,200 miles of lines and 50 miles of cables are in operation in order to facilitate standardisation or to give supplies to authorised undertakers who would otherwise have had to install generating plant. Progress in several areas is very advanced, and during the current year normal trading will commence in two or more areas with the owners of the stations at which the Board's electricity will be generated.

**The Middle West Utilities Co.** reports a total income of $23,143,153 for 1931 and a net income of $17,138,664. The surplus earnings of subsidiary companies accruing to the Middle West Co. were $24,440 and the net losses applicable to stocks owned by the company in companies not classified as subsidiaries were $342,980, making the combined surplus earnings accruing to the company $13,181,105. The common stock dividend requirements of 8 per cent., payable in stock at $10 per share, were $11,789,138, leaving $1,391,967. The directors state that conditions have made necessary a reduction in the book value of some of the assets to the extent of $35,152,210, while studies now being made show that further reductions and writing-off will be necessary. To conserve cash resources the preferred and common dividends have been passed. Plans are being considered which will provide a programme sufficiently flexible to provide for future capital requirements. The surplus and reserve accounts now stand at $55,566,958.

**The French Alsthom Co.**—The first dividend since its formation in 1928 is intimated by the Société Générale des Constructions Electriques et Mécaniques (Alsthom), of Paris, which was formed by an amalgamation of the most important manufacturing works of the Thomson-Houston Co. and the Societe Alsacienne des Constructions Mécaniques (Grafenstaden). The accounts are for nine months in 1931 and show net profits of 25.42 million fr. Including 9.82 millions brought forward and 25 millions as dividend reserve fund from the first years when no dividend was paid, the amount available is 60.24 millions, of which 31.01 millions has been written off as against 26 millions in 1930. Out of the remainder it is proposed to pay a dividend of 3½ per cent. on the ordinary shares.

**Ward & Goldstone, Ltd.,** report a net profit for the year ended March 31st last of £19,801, as compared with £19,882 in the preceding year. After deducting income tax, depreciation, and directors' fees and adding £16,107 brought in, it is proposed to pay a final ordinary dividend of 7 per cent. and to carry forward £18,537. The report states that the output of the company's manufactures during the past year exceeded all records. Towards the close of the financial year building and plant extensions were undertaken, and it is anticipated that the benefit of the capital outlay incurred will be reflected in next year's report. The death of Mr. J. H. Ward, one of the founders of the original company established forty years ago, is recorded.

**Ruston & Hornsby, Ltd.,** report a loss for the year ended March 31st last of £92,356, as compared with £34,703 in the preceding year, and after meeting debenture interest there is a debit of £119,262 (against £62,276). A sum of £50,000 has been withdrawn from the general reserve, and this with £25,919 brought in has been deducted from the year's loss, reducing the debit balance to £43,343. The directors state that buildings, plant and machinery have been maintained out of revenue, but it has again been necessary to place the annual charge for depreciation against capital reserve account. The trade depression which has affected the business during recent years was accentuated during the past year, particularly as regards export trade.

**The Lisbon Electric Tramways, Ltd.,** reports a net profit for 1931 of £172,254, as compared with £179,614 in the preceding year, to which is added £37,593 brought in, making £209,847. General and depreciation reserve receives £68,000, the staff benefit fund receives £10,000, and it is proposed to pay a final ordinary dividend of 4 per cent., making 7 per cent. for the year (same), leaving £39,741 to be carried forward. The number of passengers carried decreased from 125,002,462 to 121,592,852. Meeting: June 22nd.

**The French Thomson-Houston Co.**—The directors of the French Thomson-Houston Company report profits of 20.6 million fr. for 1931 as compared with 26.2 millions in the previous year. About one-half of this amount has been devoted to depreciation and the reserve fund and 10.4 millions has been carried forward. There is no dividend on the ordinary shares, which received 6 per cent. for 1930.

**The Altrincham Electric Supply Co.** reports a net profit for 1931 of £27,334, as against £28,861 in the preceding year, to which is added £3,312 brought in, making £30,646. Preference dividends and interim dividends on the ordinary and deferred shares absorbed £25,884, and it is proposed to pay final dividends on the ordinary shares (£1,000), and deferred shares (£1,000), leaving £2,762 to be carried forward.

**The Hydro-Electric Securities Corporation** has decided not to declare a dividend on the common stock in respect of the current quarter. A dividend of 10 cents per share was declared for the preceding quarter.

**The International Power & Paper Co. of Newfoundland** reports that after all charges, including taxes, interest, depreciation, &c., the net earnings added to the surplus for 1931 amounted to $634,630, as compared with $764,641 in 1930.

**The Kalgoorlie Electric Power & Lighting Corporation** reports a profit for 1931 of £22,442. A dividend of 6 per cent., less tax at 2s. 6d., is proposed on the ordinary shares (same), leaving £2,157 to be carried forward. Meeting: June 16th.

**The Canadian Hydro-Electric Corporation.**—The 1931 report reveals that the net revenue for the year before dividend payments was $2,305,500, as compared with $1,925,000 for the previous year, an increase of $380,500.—*Reuter* (Montreal).

**The Yorkshire (West Riding) Electric Tramways Co.** has declared an interim dividend on the 6 per cent. cumulative preference shares of 3 per cent. for the half-year to June 30th.

**The Brazilian Traction, Light & Power Co., Ltd.,** has announced a quarterly dividend of 1¼ per cent. on the cumulative preference shares.

**Companies Struck off the Register.**—The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Hindhead and District Electric Light Co., Ltd.
Knowsley Electrical Co., Ltd.
Maldon Electric Works, Ltd.

# Stocks and Shares

MONDAY EVENING.

THERE has lately been a disposition to speak as though the Lausanne Conference, taking place this week, will end in much the same way as most of the earlier Continental conferences have done: namely, in a spate of words, followed at some future date by an official report, but with nothing definite being achieved. People in the City have been inclined to scepticism to the meeting of delegations at Lausanne, and to talk as though, for more tangible results, the Ottawa Conference must be considered of greater consequence. On the other hand, this week's assembly is faced with a crisis which, if not resolved in the early future, will menace the security of the world. The Chancellor of the Exchequer, on the eve of his departure for Switzerland, spoke cheerily of the national finances and the way in which revenue continues to flow in. The Australian elections have gone in favour of the party of sanity. America is anxious to agree upon some monetary policy, the lines of which may be settled in London during the coming autumn. The Stock Exchange, taking note of these matters, continues to advise clients that safety first is still the desirable course, and speculation has fallen to a low ebb.

## Central Electricity Success

The Central Electricity Board gave the gilt-edged market something to think about by offering the large amount of £10,000,000 4½ per cent. stock, 1957-1982, at 96. The stock is to rank equally with £26,000,000 already issued, and the money is required to provide further funds for the purposes of the grid. The prospectus gave details of the manner in which the consumption of electricity has advanced by leaps and bounds over the past decade. Over 31½ million sterling has been spent with British firms in connection with contracts placed and expenditure approved by the Board. The City took a lively interest in the reception of such a substantial issue, the first effect of which upon other gilt-edged securities was to make them somewhat easier. The existing 4½ per cent. debenture stock of the Central Electricity Board rose, however, a point to 98—to the same level, that is to say, as the price of London and Home Counties 4½ per cent. debenture stock. The Central Electricity lists were open for no longer than an hour and a quarter. The promptitude with which the £10,000,000 was subscribed came as a surprise, and assisted in bringing about a rise in the prices of other stocks in the gilt-edged market.

## Home Electricity Supply Shares

County of London ordinary shares are 9d. lower at 2 1/16. On the other hand, St. James' and Pall Mall have strengthened to 29s. Comparing the other London shares, it is of interest to note that, at present middle prices, Chelseas stand at 27s. 6d., Bromptons, London Electrics and Westminsters at 28s., Kensingtons and South Londons at 28s. 6d., and Charing Cross at 29s. It will be noticed that the difference between the lowest price and the highest is 1s. 6d. per share. Edmundson's new preference shares, which came out at a guinea, have settled down in the neighbourhood of that price. The company's new 5 per cent. mortgage debenture is ¼ better at 100¾. There has been some demand for Scottish Power new preference, the North becoming a buyer, and putting up the price to nearly a shilling premium. Shropshire, Worcestershire and Staffordshire 5 per cent. debentures at 104½ are a little easier. In the Indian group, the new Madras Electric preference hardened to 9d. premium. Buyers have been inquiring for good preferences amongst Home Electricity shares, and, in response to the demand, rises have occurred in County of London preference to 25s. 6d., Scottish Power "old" preference to 25s., and Yorkshire Electric preference to 25s. 6d.

## Home Railway Stocks

Lively fluctuations in Metropolitan ordinary stock have taken place, and after being down to 49¼ and up to 53, the price on this (Monday) evening is 51¼, unchanged on the week. The market and the proprietors of the stock are still in the dark as to the reason for the very substantial rise which has occurred since the end of April, and whatever negotiations there may be on foot, the Metropolitan board evidently does not consider the time ripe for an official statement to be made. Of the other Underground shares, Underground Electric ordinary at 16s. have fallen 1s. The tendency of the Home Railway market as a whole has been towards lower prices. New low level records have been reached during the past few business days. Districts keep at 50½. The company's 5 per cent. debenture stock is quoted at 7½ premium, and the Metropolitan 5 per cent. debenture stock at 7 premium.

## Telegraphs and Cables

The market in Cables and Wireless stocks is decidedly better. The 5½ per cent. preference stock has gained 6 points at 42½. The 7½ per cent. "A" ordinary is 1 better at 12½. The buying appeared to be based on optimistic expectations of the report of the Commission which has been sitting for some time past, and whose findings are expected to be made public almost at once. Vague rumours are in circulation as to the probable contents of the report, and these rumours, although so nebulous, have sufficed to frighten the bear brigade. Globe ordinary shares are flat, losing 7s. 6d. to 3½, and the preference show no recovery after their previous fall to £6. Anglo-American Telegraph preferred, however, fell a point to 93½, following its drop of 2½ a week ago. Marconi Marines have recovered to 23s. 9d. American Telephone and Telegraph at 115 shows a fall of 5 points. International Telephone and Telegraph shares are quoted at 4½. The forthcoming report of the L. M. Ericsson Telephone Company of Sweden is awaited with unusual interest. According to advance forecasts, the company did well in the year recently concluded, but the profits, according to this rumour, may be severely reduced by the necessity for writing off substantial sums. Representatives of the company, and the International Telephone and Telegraph Company, are stated to have reached an agreement for safeguarding the interests of both undertakings. Ericsson Telephones 7 per cent. preference shares are quoted in London at 21s. 3d., this price carrying the half-yearly dividend due at the beginning of next month.

## Equipment and Manufacturing Shares

Johnson & Phillips have fallen to 15s., being 2s. 6d. down. General Electric ordinary rose 9d. to 33s. 3d. British Aluminium ordinary are dull at 20s. 9d. Henley's preference put on 5s. to 4½, the shares being of the class to which investment attention is now particularly directed. The ordinary advanced to £5. Telephone Manufacturing have gained a trifle at 2s. 7½d. Siemens, quoted officially at £1, can be bought at 19s. 6d.—possibly more cheaply. The official Stock Exchange price of 66s. 3d. for Enfield Cable ordinary also is misleading, because shares are on offer in the market at 65s.

## Dollar Stocks—and Others

Brazilian Tractions have recovered to 11½, being ½ up, after the price had been as low as 10½. Shawinigan remained flat at 11, Power Corporation of Canada at 9. Montreal Light and Power at 30 are a point down on the week.

Amongst miscellaneous movements, Atlas gave way to 7s. sellers. The preference also are lower at 18s. British Light and Power new preference shares are 1½d. discount. Ever-Ready old and new shares have met at the common price of a guinea. With the new shares, the buyer does not have to pay stamp and fee, as they are still passing in the shape of renunciation letters. Philips' Lamps are easier at 11-10½. Chloride Electrical Storage A and B shares are both quoted at two guineas.

The iron and steel market has retained most of the improvement secured upon announcement of the Government's intention to assist the industry. Babcocks are steady at 37s. 6d. Rubber shares placidly slumber.

# Share List of Electrical Companies

| | Nom. | Approx. Dividend. 1930. | 1931. | Price. June 13. | Rise. or Fall. | Yield. p.c. |
|---|---|---|---|---|---|---|
| **HOME ELECTRICITY COMPANIES.** | | | | | | |
| Bournemouth and Poole | 1 | 15 | 15 | 60/9 | — | 4 18 9 |
| Brompton Ordinary | 1 | 8½ | 8½ | 28/– | — | 5 0 0 |
| Central Electricity 4½% Deb. | Stock | 4½ | 4½ | 98 | +1 | 4 11 10 |
| Charing Cross Ordinary | 1 | 8½ | 8½ | 29/– | — | 4 16 7 |
| Chelsea | 1 | 8¾ | 8¾ | 27/6 | — | 5 1 10 |
| City of London | 1 | 10 | 10 | 38/3 | — | 5 4 7 |
| Clyde Valley | 1 | 8 | 7 | 27/6 | — | 5 1 10 |
| County of London | 1 | 11 | 10½ | 41/3 | –9d. | 5 1 9 |
| Edmundsons' 7% Pref. | 1 | 7 | 7 | 28/6 | — | 5 5 8 |
| Elec. Dis. Yorkshire | 1 | 9 | 9 | 35/– | — | 5 2 10 |
| Elec. Supply Corporation | 1 | 11 | — | 47/6 | — | 4 12 7 |
| Kensington Ordinary | 1 | 8 | 8 | 28/6 | — | 4 18 3 |
| Lancs. Light and Power | 1 | 6½ | 7 | 26/3 | — | 5 6 8 |
| London & Home Counties 4½% Deb. | Stock | 4½ | 4½ | 98 | — | 4 11 10 |
| London Electric | 1 | 9 | 9 | 28/– | — | 5 0 0 |
| Metropolitan | 1 | 10 | 10 | 42/– | — | 4 15 3 |
| Midland Counties | 1 | 7 | 7 | 28/9 | — | 4 17 5 |
| Mid. Elec. Power | 1 | 8 | 8 | 30/– | — | 5 6 8 |
| Newcastle-on-Tyne Ordinary | 1 | 6 | 6 | 23/9 | — | 5 1 1 |
| Do. 7% Pref. | 1 | 7 | 7 | 27/6 | — | 5 1 10 |
| Northampton | 1 | 10 | 10 | 40/9 | — | 4 18 2 |
| Notting Hill 6% Pref. | 10 | 6 | 6 | 11 | — | 5 9 1 |
| North Met. Elec. 6% Pref. | 1 | 6 | 6 | 25/– | — | 4 16 0 |
| St. James' and Pall Mall | 1 | 8 | 8 | 29/– | +6d. | 4 16 7 |
| Scottish Power | 1 | 8 | — | 28/3 | — | 5 13 3 |
| South London | 1 | 8½ | 8½ | 28/6 | — | 4 18 3 |
| Urban Ordinary | 1 | 7 | — | 28/9 | — | 4 17 5 |
| Westminster Ordinary | 1 | 8½ | 8½ | 28/– | — | 5 0 0 |
| Whitehall Elec. Invst. 7½% Pref. | 1 | 7½ | 7½ | 16/3 | — | 9 4 8 |
| Yorkshire Elec. | 1 | 8 | 8 | 33/9 | — | 4 14 10 |
| **HOME RAILS.** | | | | | | |
| Central London Ord. Assented | Stock | 4 | 4 | 72½ | — | 5 10 4 |
| Metropolitan | " | 4 | 3½ | 51½ | — | 6 16 9 |
| Do. District | " | 5 | 4½ | 50½ | — | 8 18 2 |
| Underground Electric | 1 | 8 | 7 | 16/– | –1/– | 8 15 0 |
| **TELEGRAPHS AND TELEPHONES.** | | 1929. | 1930. | | | |
| American Tel. & Tel. | $100 | 9 | 9 | 115 | –5 | 7 16 6 |
| Anglo.-Am. Tel. Pref. | Stock | 6 | 6 | 93½ | –1 | 6 8 4 |
| Do. Def. | " | 1½ | 1½ | 21 | — | 6 19 6 |
| Cables & Wireless 5½% Pref. | " | 5½ | 5½ | 42½ | –6 | — |
| Do. A 7½% Ord. | " | Nil | — | 12½ | +1 | — |
| Do. B Ord. | " | Nil | — | 7 | — | — |
| Globe Tel. and T. Ord. | 10 | 10 | 8½ | 3½ | –¾ | — |
| Do. do. Pref. | 10 | 6 | 6 | 6 | — | 10 0 0 |
| Great Northern Tel. | 10 | 20 | 20 | 22xd | — | 9 1 0 |
| Marconi-Marine | 1 | 15 | 15 | 23/9 | +⅛ | 8 8 1 |
| Oriental Telephone Ord. | 1 | 12 | 12 | 2⅛ | — | *5 4 0 |
| **HOME AND FOREIGN TRAMS, ETC.** | | | | | | |
| Anglo-Arg. Trams First Pref. | 5 | 5½ | — | 6/3 | — | — |
| Do. do. 2nd Pref. | 5 | 6 | — | 2/6 | — | — |
| Do. do. 5% Deb. | Stock | 5 | — | 8 | — | — |
| British Electric Traction Def. Ord. | " | 5 | 5 | 650 | — | — |
| Do. do. Pref. Ord. | " | 8 | 8 | 125½ | — | 6 7 6 |
| Brazil Traction | 100 | 8 | — | 11½ | +½ | — |
| Brit. Columbia Elec. Rly Pfce. | Stock | 5 | 5 | 89½ | — | 5 11 6 |
| London & Sub. Trac. 5% Pref. | 1 | Nil | Nil | 3/9 | — | — |
| London United Tram Deb. | Stock | 4 | 4 | 57½ | — | 6 19 2 |
| Mexico Trams, 5% Bonds | — | 5 | 5 | 22½ | — | 22 4 4 |
| Mexican Light Common | 100 | Nil | Nil | 12½ | — | — |
| Do. 7% Pref. | 100 | 7 | 7 | 20 | — | — |
| Do. 1st Bonds | — | 5 | 5 | 52½ | — | 9 10 8 |
| Victoria Falls Ord. | 1 | 15 | 15 | 60 – | +½ | 5 0 0 |
| Yorkshire (West Riding) | 1 | Nil | Nil | 4/6 | — | — |
| **MANUFACTURING COMPANIES.** | | | | | | |
| Assoc. Elec. Ord. | 1 | 6 | 6 | 16/3 | — | 4 18 6 |
| Do. Pref. | 1 | 8 | 8 | 28/– | — | 5 14 4 |
| Babcock & Wilcox | 1 | 15 | 14 | 37/6 | — | 7 9 4 |
| British Aluminium Ord. | 1 | 10 | 10 | 20/9 | –6d. | 4 16 5 |
| British Insulated Ord. | 1 | 15 | 15 | 53/9 | — | 5 11 6 |
| Brush Ord. | Stock | 10 | 5 | 55 | — | 9 1 8 |
| Callender's | 1 | 15 | 15 | 52/6x1 | — | 5 14 3 |
| Do. 6½% Pref | 1 | 6½ | 6½ | 25/9 | — | 5 1 0 |
| Crompton Parkinson Ord. | 5/– | 30 | 30 | 17/6 | — | 8 11 6 |
| Do. 8% Pref. | 1 | 8 | 8 | 27/6 | — | 5 16 5 |
| Edison-Swan 1st Pref. | 1 | 7½ | 7½ | 23/3 | — | 6 9 0 |
| Do. 5% Deb. | Stock | 5 | 5 | 92½ | — | 5 8 1 |
| Electric Construction | 1 | 5 | Nil | 7/6 | — | — |
| Enfield Cable Ord. | 1 | 25 | 25 | 3⅛ | — | 7 19 9 |
| English Electric | 1 | Nil | Nil | 8/9 | — | — |
| Do. do. Pref. | 1 | Nil | Nil | 10/– | — | — |
| Ever Ready | 5/– | 35 | 35 | 21/–xd | — | 8 6 8 |
| Ferranti Pref. | 1 | 7 | 7 | 22/– | — | 6 7 3 |
| G.E.C. Pref. | 1 | 6½ | 6½ | 25/6xd | — | 5 2 0 |
| Do. Ord. | 1 | 14 | 10 | 33/3 | +9d. | 6 0 4 |
| Henley's | 1 | 30 | 30 | 5 | +⅛ | 6 0 0 |
| Do. 4½ Pref. | 5 | 4½ | 4½ | 4½ | +½ | 5 0 0 |
| India-Rubber | 1 | Nil | Nil | 4/6 | — | — |
| Johnson & Philips | 1 | 10 | 10 | ⅝ | –½ | 6 13 4 |
| Siemens Ord. | 1 | 7½ | 7½ | 20/ xd | — | 7 10 0 |
| Telegraph Construction | 12 | 10 | 7½ | 9½ | — | — |

* Dividends paid free of Income Tax.

# Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

**1930**

34231. "Short wave systems." H. E. Hollmann and Radio Patents Corp. Inc. November 16th, 1929. (373235.)
34404/6. "Electric gaseous-discharge tubes." Claude Neon Lights, Inc. November 15th, 1929. (373200/2.)
38356. "Electrical high resistance." A. A. Archangelsky and A. W. Ulitowsky. December 19th, 1930. (373182.)

**1931**

364. "Means for indicating variation from a standard or predetermined frequency of an alternating current electrical supply system." G. F. Shotter and Elliott Bros. (London), Ltd. January 5th, 1931. (373120.)
720. "Manufacture of carbon electrodes." H. D. Elkington (Verkaufsvereinigung für Teererzeugnisse Ges.). January 8th, 1931. (373165.)
1791. "Alternating current commutator machines." N. Jopolsky. January 19th, 1931. (373243.)
2041. "Radio receiving apparatus." E. K. Cole, Ltd., and E. J. Wyborn. January 21st, 1931. (373244.)
4339. "Lampholders for electric lamps." T. Watt and Dixonia, Ltd. February 11th, 1931. (373168.)
4351. "Electrical switches of the plug operated type." Wandsworth Electrical Manufacturing Co., Ltd., T. Batchelor, and A. B. Smith. February 12th, 1931. (Cognate application No. 16567/31.) (373246.)
4721. "Electric sidelamps for railway vehicles." J. Stone & Co., Ltd., and J. F. B. Vidal. February 14th, 1931. (373133.)
4730. "Electrical insulating materials." W. S. Smith, H. J. Garnett, and J. N. Dean. February 14th, 1931. (Addition to 346382.) (373134.)
4741. "Transmission systems for picture telegraphs and the like." C. Lorenz Akt.-Ges. February 15th, 1930. (373135.)
4837. "Wireless receiving circuits." W. I. G. Page and W. T. Cocking. February 16th, 1931. (373142.)
4848. "Control systems for use with electrical amplifiers." Marconi's Wireless Telegraph Co., Ltd., and O. E. Keall. February 16th, 1931. (373145.)
4861. "Electric fans." J. Stone & Co., Ltd., and J. F. B. Vidal. February 16th, 1931. (373146.)
4924. "Apparatus or machines embodying and driven by electric motors." C. Collaro and Collaro, Ltd. February 16th, 1931. (373153.)
4926. "Wireless transmitting and receiving circuits." W. B. Mackenzie, W. F. Rawlinson, and R. A. Yeo. February 16th, 1931. (373154.)
4957. "Electric igniters." E. Hibou. February 17th, 1931. (373219.)
5020. "Apparatus for the electrical reproduction of sound." British Thomson-Houston Co., Ltd., L. B. Ault, and T. F. Robinson. February 17th, 1931. (Addition to 310284.) (373158.)
5021. "Brush-holders for dynamo electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. February 17th, 1931. (373159.)
5051. "Electric radiators." Benham & Sons, Ltd., and C. R. Allensby. February 17th, 1931. (373252.)
5052. "Electric switch contacts." Siemens & Halske Akt.-Ges. February 17th, 1930. (373195.)
5134. "Television systems and the like." J. L. Baird and Baird Television, Ltd. February 18th, 1931. (373196.)
5149. "Electric fuses." Schweitzer & Conrad, Inc. March 15th, 1930. (373173.)
5176. "Compositions for the fuseheads of electric mining and blasting fuses." Imperial Chemical Industries, Ltd., and W. O. Littlebury. February 18th, 1931. (373255.)
5197. "Telephone or like systems." Automatic Electric Co., Ltd., and A. E. Caswell. February 18th, 1931. (373177.)
5324. "Electric means for testing or controlling material." Siemens & Halske Akt.-Ges. May 10th, 1930. (373261.)
5383. "Telephone systems." Standard Telephones & Cables, Ltd. (P. J. Clemens). February 20th, 1931. (373225.)
5454. "Echo sounding apparatus and subaqueous signalling apparatus." Telegraph Construction & Maintenance Co., Ltd., and A. H. Ledger. February 20th, 1931. (373229.)
5459. "Multiple light-sensitive cell." Arcturus Radio Tube Co. March 31st, 1930. (373230.)
5528. "Loud speakers." Electrical Research Products Inc. March 6th, 1930. (373,268.)
5540. "Electric discharge lamps." Marconi's Wireless Telegraph Co., Ltd., and G. F. Brett. February 21st, 1931. (373270.)
6028. "Voice-frequency alternating current signalling arrangements, particularly for use in telephone systems." Standard Telephones & Cables, Ltd., T. S. Skillman, P. R. Thomas, and K. G. Hodgson. February 26th, 1931. (373287.)
6066. "Facsimile telegraph, television, and like apparatus." Marconi's Wireless Telegraph Co., Ltd., and H. M. Dowsett. February 26th, 1931. (373288.)
6070. "Viewing of objects by means of invisible rays." Associated Telephone & Telegraph Co. April 30th, 1930. (373290.)
6071. "Telephone systems." Automatic Electric Co., Ltd., and A. E. Caswell. February 26th, 1931. (373291.)
6102. "Electrical control of the intensity of a beam of light." Gramophone Co., Ltd., and W. D. Wright. February 26th, 1931. (373294.)
7031. "Use of thermionic valves." G. T. Evans. March 6th, 1931. (373309.)
8064. "Wireless direction finding apparatus." Siemens Bros. & Co., Ltd., and T. Price. March 16th, 1931. (373320.)
9028. "High-frequency radio transmitters and receivers." Marconi's Wireless Telegraph Co., Ltd. April 8th, 1930. (373331.)
9329. "Electric conduit or cable rack." J. B. Tannahill. March 27th, 1931. (373335.)
9434. "Artificial lines suitable for use in systems for generating electric oscillations and for like purposes." Marconi's Wireless Telegraph Co., Ltd. May 29th, 1930. (373336.)
9866. "Electron-discharge devices." Westinghouse Lamp Co. April 5th, 1930. (373338.)
9867. "Motor control systems." Westinghouse Electric & Manufacturing Co. April 18th, 1930. (373339.)
10117. "Manufacture and installation of electric cables." Callender's Cable & Construction Co., Ltd., and P. V. Hunter. April 2nd, 1931. (373341.)
10581. "Electric motor starting switches." Brookhirst Switchgear, Ltd., and J. A. Hirst. April 10th, 1931. (373344.)
11004. "Control of elastic-fluid turbine-driven electric power generating plant." English Electric Co., Ltd., A. H. Law, and J. P. Chittenden. April 14th, 1931. (373350.)
11327. "Process of and apparatus for producing artificial illumination." G. Claude. April 17th, 1930. (373354.)
11,328. "Luminescent gaseous-discharge tubes." G. Claude. April 17th, 1930. (373355.)
11657. "Electric lamps for use in fishing or other purposes." F. J. Bell and R. Boyle. April 20th, 1931. (373359.)
12410. "Arc-welding electrodes." British Thomson-Houston Co., Ltd. April 30th, 1930. (373369.)
12909. "Lamps for radiating ultra-violet light." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 20th, 1930. (373378.)
13388. "Transmitting apparatus for type-printing telegraphy." Siemens & Halske Akt.-Ges. May 9th, 1930. (373382.)
13518. "Electric signalling apparatus." General Electric Co., Ltd., and D. C. Espley. May 7th, 1931. (Cognate application 19692/31.) (373383.)
13534. "Suspension devices for electric cables, pipes and similar apparatus." C. J. Beaver, T. J. Fairfield, and R. C. Lishman. May 7th, 1931. (373384.)
13751. "Electric wind-screen wipers." R. Bosch Akt.-Ges. June 10th, 1930. (373388.)
14051. "Means for energising electromagnets." Dr. V. Leisser. June 6, 1930. (373,392.)
14243. "Trivets for electric and gas fires." H. H. Berry. May 14, 1931. (373396.)
14357. "Directional refractors for street lamps." Revo Electric Co., Ltd., F. H. Reeves, Holophane, Ltd., and S. English. May 15th, 1931. (373399.)
14637. "Combined electric switch- and fuse-gear." E. Dobson and Foster Engineering Co., Ltd. May 18th, 1931. (373402.)
16278. "Electric tumbler switches." G. E. Marr. June 4th, 1931. (373428.)
16675. "Focusing devices for electric torches." Ever Ready Co. (Gt. Britain), Ltd., and F. Beeston. June 8th, 1931. (373438.)
17150. "Traffic signalling system, and method of operating and resynchronising the motors thereof." Crouse-Hinds Co. June 12th, 1930. (373444.)
17206. "Lead-in securing devices for electric cables." R. Bosch Akt.-Ges. June 24th, 1930. (373445.)
17666. "Electrical switchgear of the ironclad or enclosed type." J. A. Crabtree. June 18th, 1931. (373451.)
17693. "Voltage regulating transformers." O. Lobl. June 18th, 1931. (Addition to 17582/31.) (373452.)
19523. "Small electric motors." R. Bosch Akt.-Ges. August 4th, 1931. (373466.)
20256. "Vacuum electric circuit interrupters." British Thomson-Houston Co., Ltd. July 14th, 1930. (373,471.)
23593. "Extinguishing of arc in electric switches." British Thomson-Houston Co., Ltd. August 21st, 1930. (373499.)
25691. "Single axle drives for electrically driven vehicles." Schweizerische Lokomotiv & Maschinenfabrik. October 6th, 1930. (373508.)
27876. "Electric induction heating apparatus." Electric Furnace Co., Ltd. October 7th, 1930. (373521.)
28565. "Voltage regulating systems for mercury-arc and like rectifiers." British Thomson-Houston Co., Ltd. October 16th, 1930. (373526.)
29599. "Control mechanisms for electrically driven sewing machines." Jones' Sewing Machine Co., Ltd., and J. Hall. October 26th, 1931. (373533.)
30580. "Synchronous electromotors for driving clocks and the like." Kienzle Taxameter und Apparate Akt.-Ges. November 5th, 1930. (Addition to 340,740.) (373537.)
31408. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd. November 12th, 1930. (373543.)
33007. "Electric time switches." Horstmann Gear Co., Ltd., and K. J. Horstmann. November 28th, 1931. (373554.)
34326. "Magneto-electric ignition devices." Eisemann-Werke Akt.-Ges. February 9th, 1931. (Addition to 367881.) (373561.)

**1932**

5058. "Radio and other high-frequency receivers." Telefunken Ges. für Drahtlose Telegraphie. February 19th, 1931. (Addition to 357913.) (373570.)

# Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 8th:—

Vucoalite. No. 530231. Class 8. Electric cables.—Edison Swan Cables, Ltd., 123-125, Queen Victoria Street, E.C.4.

Transfeeda. No. 530606. Class 8. Parts of wireless telephonic apparatus.—The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.

Volamp. No. 531429. Class 8. Electric accumulators (not for medical purposes).—The Lithanode Co., Ltd., 190, Queen's Road, Battersea, S.W.8.

Medco Brand, British Made (lettering and design). No. 531428. Class 13. Electric lamps (ordinary), &c.—Manufacturers' Export Development Co., Ltd., 6, Bloomsbury Square, W.C.1.

Reymez. No. 531590. Class 18. Engineering, architectural, and building contrivances.—A. Reyrolle & Co., Ltd., Hebburn-on Tyne.

Volpruffe. No. 531042. Class 50. Impregnated textile sleeving for electrical insulating purposes.—Faire Bros. & Co., Ltd., 2, Southampton Street and St. George's Mills, Leicester.

# New Work for Contractors

## Particulars of new works and building schemes for the use of electrical installation contractors and traders

*Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

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**Aberdeen.**—United Free Church; W. E. Gauld, architect. Alterations and additions to Morningfield Hospital; J. B. Nicol, architect.

**Akerdour** (FIFESHIRE).—Improvements, including installation of electric lighting, at Dalgety parish church; Rev. Rose, minister.

**Amesbury.**—Houses (24) for the R.D.C.; A. M. Wilson, clerk, 12, Bridge Street, Salisbury.

**Ashton-in-Makerfield** (LANCS).—Houses (100); U.D.C. surveyor.

**Aylesbury.**—Isolation hospital extensions for the Joint Hospital Board; Collcutt & Hamp, architects, 126, Wigmore Street, Portman Square, W.1.

**Ayr.**—Reference library and lecture hall, Carnegie public library (£5,000); borough surveyor.

**Barking.**—Re-erection of works, Ripple Road, for the Eastern Joinery Co., Ltd.; W. Jaggers, Ilford, chairman.

**Barnstaple.**—Re-erection of warehouse for T. P. Isaac & Co.

**Barrow-in-Furness.**—Alterations to Hotel Imperial; James Thompson & Co., Ltd.

**Berkhamsted** (HERTS).—Houses (50); J. R. Hadfield, U.D.C. surveyor.

**Bideford** (DEVON).—Houses (42); G. H. Seldon, town clerk.

**Bilston.**—School, Willenhall Road, for the E.C.; Joynson Bros., architects, 54, Lower High Street, Wednesbury.

**Birkenhead.**—Central library (£39,690) for T.C.; E. B. J. Gould, Ltd., builders, Ellesmere Port.

**Blyth.**—Alterations, Westoe Hotel, Burt Street; E. Wilkinson.

**Bristol.**—Post Office, Westbury-on-Trym (£5,000); H.M. Office of Works, King Charles Street, S.W.1.

**Bury** (LANCS).—Extensions, Aitken Sanatorium (£16,170), for the Joint Hospital Board; Mr. Ward, architect. School (£8,200) for E.C.; John Tinline, Ltd., builders.

**Cambridge.**—Extensions, Addenbrooke Hospital (£5,940); Henry Martin, Ltd., builders.

**Cardiff.**—Houses (58), Tremorfa Estate; Thomas Jenkins (14), Raymond & Bool (16), Wm. John (28). Clinic, Mental Hospital (£12,000); medical superintendent.

**Cheltenham.**—Winter gardens scheme (£130,000); J. R. Wilkins, architect.

**Cleobury Mortimer.**—Houses (20), Highley; R.D.C. surveyor.

**Clitheroe.**—Extension of Whalley sewage works; R.D.C. surveyor.

**Coventry.**—Primitive Methodist Church, Green Lane Estate; Rev. D. C. Cooper, 3, Fairfax Street.

**Cradley Heath** (STAFFS).—Cinema, Cradley Road; Webb & Gray, architects, Scotch Chambers, High Street, Dudley.

**Douglas** (I.O.M.).—Houses, Pulrose Estate; J. E. Teare, architect.

**Dudley.**—Houses, Priory Estate (214), and Wolverton Road (32); borough engineer.

**Dunfermline.**—Business stores, Townhill Road, for the Townhill Industrial Co-operative Society; secretary.

**Durham.**—New premises for boys' and girls' secondary schools, Stockton-on-Tees; county architect.

**Easington.**—Colliery mining institute (£5,000); R. Stafford & Sons, builders, Sunderland.

**Eccles.**—Houses (20); borough engineer.

**Edinburgh.**—Reconstruction of new North Church of Scotland, Forrest Road; A. Lorne Campbell, architect, 60, Castle Street.

**Essex.**—Police court house, Romford (£10,556); J. Stuart, county architect, Chelmsford.

**Exeter.**—College hostel; E. Vincent Harris, 29, St. James's Square, S.W.1.

**Farnham.**—Housing scheme, Trapes Estate; U.D.C. surveyor.

**Glasgow.**—Houses (114), Copland Road; housing director.

**Hastings.**—Reconstruction, Gaiety Theatre, Queen's Road; P. D. Stonham & Son, architects. Covered parade (£32,000); borough engineer.

**Hetton-le-Hole.**—Houses (100) for U.D.C.; G. McCall, builder, Fencehouses.

**Huyton** (LANCS).—Houses (40); U.D.C. surveyor.

**Irish Free State.**—(DUBLIN).—Clothing factory for Jno. Barron & Sons; P. J. Lynch, 21, Orwell Park, Rathgar. (ENNISTYMON, Co. CLARE).—Hospital (£6,963); County Board of Health. (KING'S Co.).—Technical schools, Birr, Tullamore, Ferbane, Shinrone and Rhode; Vocational E.C. (WATERFORD). —Houses (21), Rathfadden; borough surveyor, 12, The Mall.

**Isle of Ely.**—School, Parson Drove; R. D. Robson, education architect, County Hall, March.

**Lanarkshire.**—Houses (140), with electrical work, for the C.C.; P. C. Smith, 13, Clydesdale Street, Hamilton.

**Lincoln.**—Houses (40); city surveyor.

**London.**—(BROCKLEY).—Housing scheme (30 acres); L.C.C. architect. (EDMONTON).—Factory premises, Pretoria Road; Commercial Structures, Ltd., builders, 38, Canal Road, N.1. (KENSINGTON).—Buildings, Cornwall Road and Stanford Street, for Prudential Assurance Co., Ltd.; E. Bevington. (LEE).—Parish hall, Baring Road; Travers & Grant. (LEWISHAM).—Houses, Ravensbourne Park and Bankhurst Road; Highfield Estate (Ravensbourne Park), Ltd. (LEYTON).—School (£28,654) for the Borough E.C.; Perrys (Ealing), Ltd., builders. (MARYLEBONE).—Block of flats, Abbey Road; Gunton & Gunton. (SOUTHWARK).—Premises, Stamford Street, for J. Sainsbury, Ltd.; Fox & Baily. Flats (93), Doddington Grove; borough engineer.

**Luton.**—Conservative club house (£8,000), with electrical and central heating work; Manning & Steel, architects; J. T. Garrett, builder.

**Maltby** (YORKS).—Houses (108), for U.D.C.; Morgan R. Jones, surveyor.

**Malvern.**—Houses (48) for U.D.C.; Wilesmith & Son, Lewis and Wilde, Powick & F. J. Hill, builders.

**Manchester.**—Soap works, Trafford Park, for Thomas Hedley and Co., Ltd., Newcastle-on-Tyne.

**Market Rasen.**—Houses (35); U.D.C. surveyor.

**Neath** (GLAM.).—Extensions to the Cymla Tuberculosis Hospital; E. Cym Jones & Arnold, architects, Gt. Western Chambers, Bridge Street, Neath.

**Newport** (I.O.W.).—Houses (20), Barton Street; Borough engineer.

**Oxford.**—Blocks of 80 flats, with electrical work, for Woodstock Estates, Ltd.; R. Fielding Dodd, architect; J. Parnell and Son, builders, Rugby.

**Peterborough.**—Houses (180), Park Lane Estate; city engineer.

**Retford.**—Court house (£8,500); borough surveyor.

**Rochester.**—Laundry extensions, St. Bartholomew's Hospital; Read & MacDonald, architects, 2, Bloomsbury Place, W.C.

**Rowley Regis.**—Houses (170), Grace Mary Estate, for U.D.C.; C. Buckley, clerk, Old Hill, Staffs.

**Rugby.**—Housing scheme (nine acres), New Bilton; U.D.C. surveyor.

**Ryton-on-Tyne.**—Houses (100); Mr. Dalton, U.D.C. surveyor, Council Offices.

**St. Albans.**—Houses (24), Colney Heath, for R.D.C.; Payne Bros., builders, Leavesden.

**St. Helens** (LANCS).—Central depôt (£40,700) and school, Robins Lane; borough engineer. Houses (22), Pitt Street, for the United Building Co., Ltd.

**Salford.**—Police divisional headquarters, Regent Street (£6,400); borough surveyor.

**Scarborough.**—Houses, Northstead Estate; borough engineer. Factory extension, Durham Street; Swift & Sons.

**Sheffield.**—Church of St. Aidan (£8,000); Rev. J. G. Speakman, vicar.

**Skegness.**—Sewage disposal scheme (£29,300), for U.D.C.; W. H. Radford & Son, engineers, Nottingham.

**Slough.**—Dairy premises, Ledger Road; Slough & District C.W.S., Farnham Road.

**Southampton.**—Telephone exchange extensions, Ogle Road, for H.M. Office of Works, King Charles Street, S.W.1.

**South Shields.**—Flats (198), Egerton Road; borough engineer. Ice cream factory, for J. Gallone; Howard Hill, architect. Greyhound race track, Horsley Hill, for Kendal Trust; Oliver and Roberts. Rebuilding Empire Theatre as cinema, Union Alley, for Moss Empires, Ltd.; W. & T. R. Milburn, architects. Rebuilding Synagogue, Ogle Terrace; T. A. Page & Son, architects.

**Spalding** (LINCS).—Houses (40), for U.D.C.; A. E. Palmer, architect, 1a, Pinchbeck Street.

**Stanley** (Co. DURHAM).—Housing scheme; U.D.C. surveyor.

**Stevenage** (HERTS).—Houses (80), Ellis Avenue; U.D.C. surveyor.

**Stretford.**—Houses (41), Wilton Avenue; H. Hampson & Co. Refinery, Trafford Park Road; N. Kilvert & Sons, Ltd.

**Sunderland.**—Houses (100), Ryhope and Tunstall; E. Hitchens, R.D.C. surveyor, Council Offices.

**Uttoxeter.**—Nurses' home; T. H. Thorpe, architect, 23, St. James's Street, Derby. Houses (100); U.D.C. surveyor.

**Wakefield.**—Houses (100), Eastmoor; city engineer.

**Wallsend-on-Tyne.**—Houses (204), Bewicke Estate and elsewhere; J. Blench, borough engineer, Town Hall.

**Ware** (HERTS).—Water supply pumping plant, with electrically driven centrifugal pumping apparatus; R. W. Grantham, U.D.C. surveyor.

**Warwickshire.**—School, Kenilworth; A. C. Bunch, county architect, Shire Hall, Warwick.

**Weymouth.**—Cinema for Picture House (Weymouth), Ltd.; Harry Clayton, architect, Chesterfield.

**Whickham-on-Tyne.**—Houses, Swalwell and Dunston; T. Fenbow, U.D.C. surveyor, Council Offices.

**Wincanton** (SOMERSET).—Dairy, for the Sparkford Vale Dairy Co.

**Wingate** (Co. DURHAM).—Rebuilding premises, Station Lane; C.W.S., Ltd., Architects' Department, 90, Westmorland Road, Newcastle.

**Wolverhampton.**—Licensed premises, Princess Street; W. Butler & Co., Ltd. Mills, Cable Street; Monmore Green Rolling Mills Co., Ltd. School, Bushbury Hill (£8,000); E.C.

**Woodford** (ESSEX).—Development of estate; T. Legg, architect, London.

**Workington.**—Warehouse, Finkle Street; Graces Bros.

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## "A Jury's Advice"

In our issue of May 20th, on p. 754, we reported an inquiry by a coroner's jury into the death of a girl from electric shock. Subsequent investigations show that no blame attached to the kettle to which reference was made, the facts being as follows: The kettle had apparently been boiled dry and the automatic safety device was found to have operated satisfactorily and to have ejected the connector. The girl presumably encountered some resistance to the connector's replacement, owing to the pressure of the automatic spring, and attempted to remedy this by poking the terminal sockets of the connector (not the safety device) with a pair of scissors while the current was switched on. The connector was of the earthed pattern, fitted with three-core cab-tyre cable; consequently the spiral-spring cable protector at the back of the connector plug was earthed, and the girl, who was holding this, received the full potential across her body. This kind of accident could have occurred with any apparatus and was not due to the connector's use with a safety kettle.